

Landwards

Agriculture • Horticulture • Forestry • Environment • Amenity

IAgrE Professional Journal

www.iagre.org

Volume 70, Number 3

Autumn 2015

BRAINS BEHIND THE OPERATION

Modern engines now rely on sensors and computers. Award winning feature by Andy Collings taking a look at the workings of the engine control unit



In this issue...



Sustainable water management



DBT Awards presented



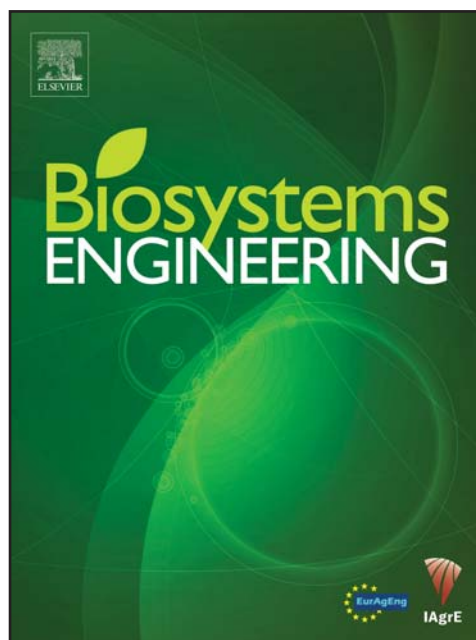
Jerry gains LTA4 status



Farm Safety Week 2015

Biosystems Engineering

Biosystems Engineering, owned by IAgRE, and the Official Scientific Journal of EurAgEng, is published monthly with occasional special issues.



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www.iagre.org/publications/bioeng



The Managing Editor of *Biosystems Engineering*, **Dr Steve Parkin**, has kindly summarised some of the papers published in the last three issues which he thinks may be of interest to IAgRE members

Biosystems Engineering

Volume 133, May 2015, Pages 64-70

Effect of blade oblique angle and cutting speed on cutting energy for energycane stems

Sunil K. Mathanker, Tony E. Grift, Alan C. Hansen

University of Illinois at Urbana-Champaign, Urbana, IL 61801, USA

University of KwaZulu-Natal, South Africa

Energycane is a promising bioenergy crop for warm south-eastern US regions and existing sugarcane machinery is being adapted for energycane cultivation. Because of energycane's comparatively higher fibre content and smaller stem diameters, the cutting blades must be optimized for energycane harvesting and size reduction. To optimize cutting blade designs, this study investigated the effect of cutting speed and blade oblique angle on cutting energy. An impact type cutting mechanism was used to determine the cutting energy cost of individual stems. The results showed that the specific cutting energy increases with cutting speed. Comparisons with sugarcane studies indicated that optimisation of cutting speed and blade oblique angle can result in significant savings in cutting energy, whilst simultaneously improving the quality of cut. This study emphasises the need for further investigation of the energycane cutting process especially at higher cutting speeds with cutting devices with varying moments of inertia.

Volume 135, July 2015, Pages 61-72

Optimal reservoir capacity for centre pivot irrigation water supply: Maize cultivation in Spain

A. Izquier, P. Carrión, J.M. Tarjuelo, M.A. Moreno

University of Castilla-La Mancha, 02071 Albacete, Spain

Centre pivots are one of the most widespread irrigation systems in the world. The aim was to develop a tool to optimise the design and management of the water distribution and centre pivot systems seeking to minimise water application cost per unit area, including investment, operation, and maintenance costs. With this aim, two options were considered: to feed the centre pivot 1) directly from an aquifer or 2) using a regulation reservoir. A software tool DEPIRE (design of centre pivot with regulating reservoir), was developed and implemented in MATLAB. It determines optimal flows, pipe diameters, pumps power and the volume of the regulation reservoir for any crop water requirement, different electricity rates and water availability in the tube well. With this tool, the effect of the irrigated area, dynamic water level in the aquifer and the pumping flow rate was evaluated for a maize crop in Spain.

Volume 134, June 2015, Pages 20-30

Feasibility of ambient loading of citrus fruit into refrigerated containers for cooling during marine transport

Thijs Defraeye, Pieter Verboven, Umezurike Linus Opara, Bart Nicolai, Paul Cronjé

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As an alternative to forced-air precooling, warm loading of citrus fruit into refrigerated containers for cooling during marine transport was explored. This practice could provide several logistic and economic savings. Although successful for resilient citrus fruits, the cooling process and performance of ambient loading have not been explored in a systematic manner. There is still a considerable potential to optimise the implementation of the technique and to apply it to more sensitive citrus or other fruits. Calculations identified the required cooling capacity of a refrigerated container as a function of the envisaged fruit cooling time, and these were complemented by a full-scale experiment. Although a refrigerated container was theoretically able to cool the produce in less than 5 days, the experiment showed that these cooling rates are not currently achieved in practice, bearing in mind that step-down cooling was applied. Future improvements in the technique point towards an improved box design and better stacking on the pallet, and to reducing airflow short-circuits between pallets.



The Professional Journal for Engineers, Scientists and Technologists in Agriculture, Horticulture, Forestry, Environment and Amenities

Landwards

EDITORIAL:

Brains for brawn

How apt that our lead feature in this issue of *Landwards* should focus on probably the most important evolution in farm machinery over recent years.

For so long, the quest has been for bigger and bigger tractors and equipment. Today, brawn, whilst not being replaced, is being supplemented by brains. It is a process that has been evolving over the past decade.

For many in the UK today, the story of farming centres around the plight of dairy farmers. The impact on their community has been harsh. Closure of many long-established family dairy farms caused by world events outside their control. They have been spirited and energetic in the defence of their industry, but the reduction from 28,000 dairy farms in 1995 to nearer 9,000 tells its own story.

Particularly when cattle numbers have only dropped by around 7%, whilst yield per cow has increased by 11 per cent since 2008. Efficiency and technology has been the solution available to dairy farmers, and the farming industry in general, to meet increasing demand and combat external pressures.

Agricultural practitioners have been driving this quest for greater efficiency for some years - and now it seems that message is getting home to the 'money-men'.

Investors are getting into agricultural technology in a big way. In the first half of 2015, agri-tech investment hit \$2.06 billion, compared with \$2.36 billion in the whole of 2014 (itself a record breaking year).

The attraction is the rapid development of smart farming, data-driven precision agriculture, cloud computing and intelligent information services. According to one analyst, "What is going to drive growth in the next 30 - 50 years is information technology."

Data collected on weather, soil conditions, crop yields, equipment efficiency, water and other variables which will be analysed and made available to farmers in a bundled concise format.

For IAgRE and its counterparts around the world, the coming years could well be the most exciting and challenging of any era in their long history.



CHRIS BIDDLE
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Volume 70, Number 3 2015

THIS ISSUE

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Clive Bound retires

From Easton and Otley College

A well-known vice principal of an East Anglian college has retired from his role

62 year old Clive Bound was born in Wales. He joined the senior management team at Easton and Otley College seven years ago having previously worked at Lincoln University.

Mr Bound - who initially trained as an agricultural engineer, said, "I've enjoyed working with colleagues and have mixed feelings about leaving. I'll miss the people. Retirement will be quite quiet in comparison to college life I should imagine although I'm not short of things to do."

Mr Bound is looking forward to spending more time with his six month old grandson (George) and holidaying on his boat that is situated in Dijon, France.



In terms of a legacy, he added, "Overall, my time at the college has been to try and facilitate success and fantastic experiences. The thing that I'm most proud of would be leading a team of staff in helping the college secure a good Ofsted grading post-merger."

And if he could sum up his time at the college in three words, he added, "the words I would use would be very, very, busy"

The new vice principal of the college is Malcolm Ferguson. He is 59.

Of his plans for the future of the college, Mr Ferguson said, "I've been really impressed with the industry links that the college has. That was one of the attractions in coming to the college. A key challenge for me is to maintain and build on this."

"We need to make sure that we prepare our students for the future and help them progress within education or employment."

Trial images taken of fields around University

Drone experts team up with Harper Adams



International Unmanned Aerial Systems provider, PrecisionHawk, has teamed up with Harper Adams University to deliver drone training in exchange for aerial imagery of the university's campus.

As part of a growing relationship established through the Unmanned Aerial Systems (UAS) Special Interest Group, PrecisionHawk visited Harper Adams to fly one of its Lancaster vehicles as part of a training and demonstration session for its users.

During this session, a range of photographs were taken of the campus, primarily a trials field used to assess the effect of farm traffic on crop yields and soil structure.

Research Assistant at Harper Adams, Jonathan Gill, who is also a qualified drone pilot, said, "Having PrecisionHawk host their training session on campus has proven a fantastic opportunity to obtain high-quality aerial images of our research, which clearly show how the plots within the field have developed."

"This visual representation from the sky gives a completely different perspective on the field, and we are delighted to be developing this mutually beneficial relationship with fellow drone enthusiasts."

PrecisionHawk prides itself in providing highly intelligent, user-friendly, UAS for remote sensing. Neil Gabriel,

PrecisionHawk's Training and Operations Manager for Europe, said, "At PrecisionHawk, we are very keen to work with leading establishments like Harper Adams University."

"Through these links, we are able to foster the development of new techniques such as sophisticated image processing algorithms which help to translate raw aerial imagery into actionable data, enabling the farmer or agronomist to create precision field prescriptions that are an essential component of delivering a successful precision farming system."

Chris Harry Thomas, VP Agriculture and Head of European Operations at PrecisionHawk added, "PrecisionHawk are very pleased to be working with Harper Adams University on this training initiative and other projects."

The UAS Special Interest Group is a membership group focused on the application of unmanned aerial systems in agriculture.

It is supported by the National Centre for Precision Farming at Harper Adams, and founder member URSULA Agriculture. Its membership broadly reflects the UAS in agriculture industry, including UAS operators, operations and service providers, technologists, agronomists, agricultural training and academia.

“This visual representation from the sky gives a completely different perspective on the field”

Training to support CPD

IAgrE links up with AEA Training for Business, writes
Peter Leech, IAgrE Past President and AEA Training Consultant



As part of a new initiative launched by IAgrE to demystify, simplify and enable Continuing Professional Development (CPD) IAgrE have strengthened links with AEA on behalf of members to enable access to the AEA Training for Business curriculum of industry specific management, business and soft skills courses.

Launched in 2014 to fulfil AEA small and medium business members needs to access management, business and soft skills training, AEA Training for Business (T4B) has just launched its second seasons programme. AEA T4B has established itself with a reputation for delivering fair value courses on relevant subjects delivered by industry specific knowledgeable training delivery professionals and on this basis has expanded the programme for the 2015/16 season with additional subjects.

The AEA training courses are open to all companies or individuals with specific relevance to those working in the Landbased industries and seeking to enhance their skill levels on an ongoing basis - in other words Continuing Professional Development. In this new link with IAgrE all courses are open to all IAgrE members at whatever grade and qualify for IAgrE CPD training

hours as part of the new simplified CPD initiative, explained later in this issue of *Landwards*, starting on page 27. The AEA Training courses will be accredited with the relevant IAgrE CPD hours.

The AEA T4B Training courses cover many different subjects from basic Excel spreadsheet training up to Leadership Management with everything concerning Health & Safety, presentation, negotiation and finance skills in between. There are also very specific courses for industry professionals working in the areas of Sales, Service

“Training courses are open to all companies or individuals with specific relevance to those working in Landbased industries”

and Parts, especially with a focus on the relationship between manufacturers and dealers. Details of the 2015-16 AEA Training for Business programme can be accessed directly on the AEA website at <http://aea.uk.com/aea-training-for-business>

The AEA Training courses are delivered by industry professionals at the AEA Training Centre in Hampton, Peterborough

AEA T4B courses are very reasonably priced as the AEA remit for this service is not for profit but as a service to its members and industry. While the courses are not cheap due to the quality provided they represent very good value due to the industry specific nature of the subjects, the industry specific professional delivery and the fellow delegates all being from the Landbased industries.

IAgrE members are encouraged to review the AEA Training for Business offer at <http://aea.uk.com/aea-training-for-business> where specific dates, pricing and an enrolment form are available.

Remember all AEA Training for Business courses carry CPD hours recognised by IAgrE.

Jerry gains LTA 4

Jerry Stansfield based at Farol, Byfield has just been awarded LTA 4 (Landbased Technician Accreditation), the highest award for a technician who next year will see 25 years of service for the John Deere Dealer.

The LTA scheme is backed by many major manufacturers in the agricultural, forestry, groundcare and horticultural sectors providing a nationwide benchmark for monitoring and accessing technicians. LTA 4 is the highest achievement for a professional technician and is achieved after completing the first 3 tiers with a proven and accessed track record.

Jerry started with Farol back in 1991 and has remained with the company to become one of their most professional technicians and the LTA has shown his exceptional diagnostic and technical abilities together with customer and technical mentoring skills. “The most challenging part of the exam was fixing unknown faults within a set time but that is also my favourite part of



Jerry Stansfield of Farol Ltd being congratulated by Christian Nightingale of John Deere

my everyday job - a challenge”, commented Jerry.

With a keen interest in farming and engineering it seemed an obvious path for Jerry to take and actively encourages the apprentices at the depot. “It is a varied and interesting career and you are at the cutting edge of technology, hard work produces high award”.

Council meeting

The next IAgrE Council Meeting will be held at Wessex Grain on 22 October by kind invitation of Simon Wilcox.

The Council Meeting will be in the morning and the afternoon will afford the opportunity to look around the site and find out about Wessex Grain.

We would like to invite local members to attend the lunch and tour.

Bookings should be made through the IAgrE Secretariat at secretary@iagre.org Numbers are limited.

Need a consultant?

IAgrE have a page on the website where members may advertise their Consultancy Business.

You can find the list in the Resources section of the website at www.iagre.org/resources/consultants

If you are a consultant and wish to be included on the list please contact the Secretariat at secretary@iagre.org

Calling all Mentors

With the generous support of the Douglas Bomford Trust, IAgRE is offering an opportunity for mentors, new and established, to join a training day later this year to find out more about the role of the mentor and how good mentoring will help to develop all IAgRE members whether new to the institution or looking to become registered with the Engineering Council or Society for the Environment. We are looking to expand our mentoring team and if you would like to get involved, please contact the IAgRE Secretariat.

We are particularly keen to engage with those IAgRE members with the people skills, keenness to support others, and understanding of professionalism to help us with this important and vital role. In most cases, mentoring will consist of telephone contact and e-mail exchange of information and advice. We offer our IAgRE mentors the opportunity to share experience through face to face meetings or webinars.

This is a great way for you to support your Institution and to help develop future engineers and technicians.

Honda 'Apprentice of the Year'

York ATV technician honoured

JOHN Staveley of Taylor ATV in York has won the prestigious title of Honda (UK) 'ATV Apprentice of the Year' 2015.

Steve Morris, Head of Power Products for Honda (UK), presented John, 19, from Wray in Lancashire, with his award recently at a special ceremony to mark the achievement of 49 young graduates who have successfully completed a Honda (UK) apprenticeship this year.

The ceremony took place at Honda (UK)'s bespoke training facility, the Honda Institute, in Slough. In attendance were senior management from Honda (UK) and British Touring Car Championship (BTCC) front-runners, Matt Neal and Gordon Shedden, of Honda Yuasa Racing.

Honda (UK) offers apprenticeships across its three core business areas of Cars, Motorcycles and Power Products. The Apprentice of the Year award is given to the candidate who truly excels in their specialist area, with nominations taken from Honda's Apprentice Trainers, Assessors and Managers. Nominations are judged against specific criteria and the overall winner is then identified by the Apprentice Programme Management Team.

John comments, "Growing up on a farm I have been around ATVs for as long as I can remember, and I've always been fascinated



L-R: Apprentice of the Year John Staveley with Tom Taylor of Taylor ATV

by engines. I started work experience at Taylor ATV during my school holidays and really enjoyed it as it gave me the opportunity to get to know and understand the product. I was delighted when Taylor's offered me an apprenticeship and I've loved every minute of it. I'm really looking forward to continuing my career here."

Innovation in Agri-Tech event at Royal Academy

The next *Innovation In . . .* event to be held at the Royal Academy on October 12th, 2pm-6pm, will feature Prof Dick Godwin HonFIAgRE, Trevor Tyrrell, CEO, CLAAS UK and Philip Garford of Garford Farm Machinery.

Attendees will hear how agriculture is being transformed by engineering innovations in ICT and sensors, precision farming, and advanced understandings of the interactions between machines, biological systems and the environment.

This latest in the Academy's *Innovation in . . .* series of events will showcase a selection of the most recent advances in agri-tech. It will focus on technologies that have successfully reached market or are expected to in the next five to ten years.

Tickets cost £20. Visit www.raeng.org.uk

Programme

- 2.00pm Welcome by the Chair Professor Richard Godwin FREng, Visiting Professor, Harper Adams

University; Emeritus Professor, Cranfield University

- 2.05pm Keynote address

Session 1

- 2.40pm Efficient Agricultural Systems: from machine to farm, Trevor Tyrrell, CEO, CLAAS UK
- 3.00pm Robocrop: precision weed control and sprayer technology, Philip Garford, Managing Director, Garford Farm Machinery Ltd
- 3.20pm Refreshment break

Session 2

- 3.50pm Scaling up precision irrigation, Dr Mark Else, Programme Lead - Resource Efficiency for Crop Production, East Malling Research
- 4.10pm eCow: real-time rumen monitoring, Professor Toby Mottram, Founder and Chief Engineer, eCow

Session 3

- 4.30pm Panel discussion: capturing

agri-tech innovations

Panellists: Dr Helen Ferrier, Chief Science and Regulatory Affairs Adviser, National Farmers Union representative

Robert Merrall, President elect, IAgRE

Calum Murray, Programme Leader - Sustainable Agriculture & Food, Innovate UK

- 5.25pm Closing remarks by the Chair
- 5.30pm Drinks reception and display viewing
- 6.30pm Close



Prof Dick Godwin HonFIAgRE

Tales from the Riverbank

IAgrE President, MARK KIBBLEWHITE

I came upon an almost timeless scene recently. It was a worker clearing sluice grates that lead to a bypass above a small weir at a point where several streams come together on the River Brit.

We got chatting and what came across to me was a very wise and committed person diligently making sure that the river is working properly. It turned out that he covers a huge patch for the Environment Agency - right round to Poole, including not just the Brit but the Frome and its tributaries, all flashy catchments that flood regularly.

He told me his experience stretches back more than 30 years and it occurred to me that I was probably talking to the greatest living authority on Dorset's beautiful rivers, somebody who has regularly visited every nook and cranny of the local catchments and knows intimately the human and cultural landscape as much as the fluvial one.

It was after I asked him if he would soon be allocated an understudy to teach before he retires in 18 months that I got thoughtful. He said that even if one was allocated, and that seems unlikely, he thought a youngster would not be able to hack the early starts, travelling and long hours.

I have a feeling he may be right. On the face of it, it is not a glamorous job and I suppose the pay is not wonderful and sadly nor is the future job security, so would it motivate a younger person?

What a topsy-turvy land we are living in! Here is a strategic role and one that relies on huge experiential knowledge. If the job is done properly the risk of flooding to farms and villages is controlled but if not then the hazards will accumulate - the economic value of the role in terms of flood avoidance has to be seriously big, my guess is several million pounds per year. The

responsibility is significant. And at some level I suppose the job might even be seen as romantic - in a rural idyll sort of way - and certainly it should offer interest and satisfaction.

Walking on after a cheerful farewell, I reflected that this guy should be put up for an Honour. I also began thinking generally and here are some of my conclusions:

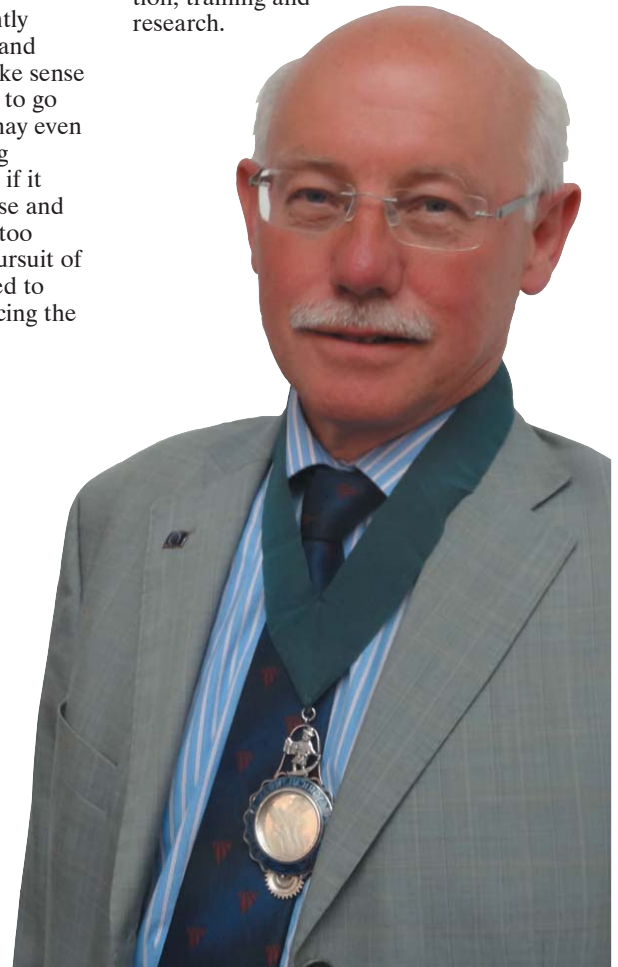
- Jobs that have and continue to be seen as lower-grade semi-skilled manual ones need re-assessment. With technology and cost-efficiency programmes there are very few unskilled manual jobs left outside retail and urban services. This is especially true in agriculture where labour productivity has increased dramatically and what were known as farm labourers once are highly skilled technicians today. There is a need to re-calibrate values.
- There is no substitute for experience. However comprehensive formal education is provided it cannot replace the 'know-how' that builds up through doing a job, including when things go wrong and solutions are found and remembered.
- There is a great confusion currently between economic management and financial accountancy. It may make sense from an accountancy perspective to go for short-term cost control and may even be unavoidable if funding is being removed but it makes little sense if it sacrifices true value, such as a wise and experienced workforce. There is too much short-termism around in pursuit of short-term advantage and we need to avoid falling for simplistic 'balancing the books' propaganda.

So what about our Institution? What should we be doing to address these issues?

Firstly, we need to champion and support better the skilled technicians who are working in farm businesses, as we are already striving to do for those who work in the dealer network. How can we develop a farm engineering technician qualification that provides additional job status and supports recruitment and development?

Secondly, we should make more of the 'experience route' to qualifications. The underlying academic knowledge has to exist in candidates but what opportunities are there for extending proper recognition of experiential learning, especially for technician level qualifications? And are we placing enough emphasis on experience alongside academic qualifications for the higher grades?

Thirdly, we need to better communicate the value of our members to their employers and where appropriate speak out against short-term decision-making driven by financial rather than economic imperatives and that threatens the future agricultural engineering workforce, including from cuts in public investment in education, training and research.



We should make
more of the
'experience
route' to
qualifications

A worrying undersupply of teachers & trainers



Alastair Taylor

“We don’t make anything in this country anymore!” How often do you hear people say that?

As I write this, the Society of Motor Manufacturers & Traders reports that the UK commercial vehicle manufacturing output in 2015 has grown almost thirty percent in the first six months of the year making this the most productive year since 2008.

It is quoted that we are building more cars in this country than we have ever built. We all wish it was the same for tractors! Although there has been a recent improvement, the overall sales figures for 2015 are depressing.

We manufacture a lot of things in this

country. Everyone tells me that our engineering expertise is second to none in terms of innovation and creativity. A visit to the Cereals Event or LAMMA in January certainly shows that we have a fantastic array of farm machinery manufacturers augmenting the global brands. There are a range of farm machinery innovations which we celebrate through various awards and competitions and can I thank those IAgRE members who join the judging panels.

It depresses me that people are so keen to run down our manufacturing industry. Have they realised the negative impact of their comments on encouraging young people

to consider a career in engineering and technology? I am sure we are now reaping the negative impact of the wholesale restructuring of our manufacturing industries which were such a feature of the seventies and eighties. Having lived through that period, I can see why a young person (and their parents) would think twice about a career ‘on the tools’ or in the ‘design office’.

The problem doesn’t stop with the recruitment of young people to courses in engineering and technology. Of particular concern is the recruitment of people to teach these. For a number of years, our colleagues in universities, land-based col-



Attention all aspiring professionals!



Professional Registration through IAgRE

Being a member of IAgRE is just part of being a professional. Adding a professional qualification to your name is a further important statement which sets you apart from others.

In addition to administering the Landbased Technician Accreditation schemes (LTA & ParlourSafe) on behalf of our sector, IAgRE has licences from the Society for the Environment and the Engineering Council to award the following professional qualifications to those who are suitably experienced and/or qualified:

**Chartered Environmentalist
Engineering Technician
Incorporated Engineer
Chartered Engineer**

**CEnv
EngTech
IEng
CEng**

One or more of these professional qualifications after your name:

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- Demonstrates that you have been judged as being competent by your peers
- Establishes that your professional credentials are on a par with other Chartered professionals such as Chartered Scientists and Chartered Accountants
- Provides you with international recognition

To find out more about obtaining professional qualifications through IAgRE, email us at membership@iagre.org, visit our website or call our Membership department on 01234 750876

www.iagre.org



leges and training providers have experienced severe difficulties in securing the services of trainers, instructors and lecturers. I am told that the same goes for manufacturers training schools.

The Institution, and others like us, has a role to play here. We need to challenge government to consider the impact of an undersupply of teachers and trainers. How can it be right that the monies for schools education is ring fenced and safe from the onslaught of government cuts whilst colleges and training providers are experiencing endless cuts in their core funding. At the same time, these colleges and training providers are expected to put right the ills of compulsory education such as improving GCSE grades in Maths and English.

Whilst the pay for teachers has improved over time, those working in colleges have experienced, at best, a pay freeze, and in many cases a real term cut. We should question why a master technician working for a machinery dealership might take a pay cut to move into teaching - surely the opposite should be the case. Surely it should be viewed as an accolade to progress to being a trainer or lecturer, something you want to do, something aspirational. That was certainly the case at the start of my own career.

How can this be right when we have a government pushing our industrial strategy and seeking to grow apprenticeship numbers - moving our technology base to put us at the forefront? It just does not stack up!

Government must listen to us engineers and find monies to support premium payments for those becoming trainers and instructors across the engineering disciplines. This is critical to the future success of our country

So what can we do?

Nothing on our own I would suggest. We need to work with all of our partners, colleges, training providers and industry, to make teaching look more appealing. We need to challenge the prejudices - that there is too much paperwork in education, that apprentices and learners are poorly behaved, that college management is unsupportive. Whilst some of this may have some truth, most trainers and lecturers would agree with me that there is little more rewarding than seeing a young person flourish and get on in life. That said, rewards like this do not pay the bills!

With all of this in mind, we are embarking on a journey to move forward on this important matter.

Firstly, we are looking to bring more trainers, instructors and lecturers into IAgRE membership to reap the rewards of being part of our community.

Secondly, we are working with our

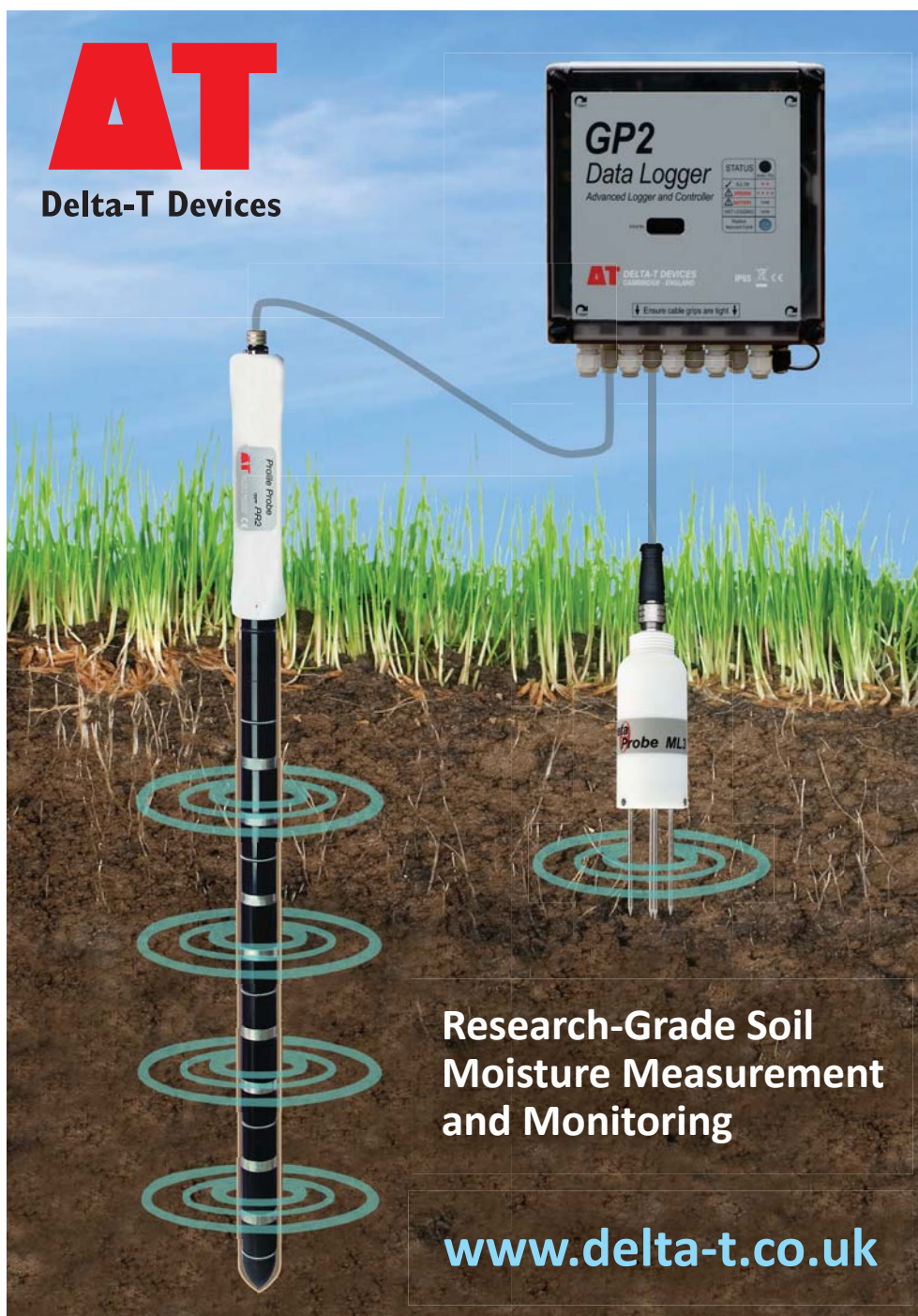
“ Government must listen and find monies to support premium payments for those becoming trainers and instructors ”

LE-TEC colleagues to arrive at a joined up approach to tackle the challenge.

Thirdly, we are going to challenge those we work with, The Engineering Council, Royal Academy of Engineering, BIS, and

others, to realise our ambition.

The alternative is to give in to the soothsayers and decide 'not to make anything in this country anymore'.



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Studentships and Prizes

AT CRANFIELD UNIVERSITY

The graduation ceremony at Cranfield University held on Friday 26th June saw several students who have been supported by The Trust receive their degrees as follows:

- **Joanna Niziolowski** - received her PhD for her project work on '*Optimising soil disturbance and mulch attenuation for erosion and runoff control in asparagus*

crops'. Joanna also received the Shepperson Memorial prize for the best thesis applying engineering applications to agriculture.

- **Raed Al-Asadi** - received his PhD for his project work on '*Combined impedance and visible and near infrared spectroscopy techniques for non-invasive in situ measurement of soil compaction*'.
- **James Ulyett** - received his PhD for his

project work on '*Engineering biochar for arable soils and the impact on nutrient dynamics*'

- **Matthew Downie** - did not attend the ceremony but was awarded an MSc by Research for his work on the measurement of multiple trace gas emissions from environmental systems using the soil lysimeters at Cranfield University.

Travel Awards

The Douglas Bomford Trust jointly funded a team of four students to travel to the University of Maribor in Slovenia to take part in the Field Robot Event 2015. Participation in the event involved:

- Designing and testing a robot at the University prior to travelling to the event;
- Getting the robot to complete four tasks as part of the competition -
- **Task 1 - Basic Navigation** - involved progressing through a row crop, travelling down the rows and completing turns into the next row at the end of a row;
- **Task 2 - Advanced Navigation** - involved following a more complex path through the crop rows and taking account of missing plants in the row;
- **Task 3 - Weed detection** - to detect 'good' and 'dried' plants and produce a map of the plant area;
- **Task 4 - a 'Freestyle' section** where teams could demonstrate a feature of their own choosing.

An important aim of the project was to create a platform for future groups at Harper Adams University as well as compete in the 2015 event.

The group consisted of four final year Masters Students with two studying Agricultural Engineering and two studying Off Road Vehicle Design. The group had little robotics and programming experience before starting this project and ideally wanted to keep the robot as simple as possible.

The final robot consisted of an adapted Maverick Scout RC chassis, an



The team from Harper Adams (Alec Henderson, Jake Smith, Max Thorne and James Townley) competing at the Field Robot Event 2015 in Slovenia

Arduino Mega as the controller, two LED diffuse scanners and four Ultrasonic sensors for the navigation of the robot. The selection of these sensors proved to be successful allowing a Double Ended Control Strategy (DECS), to be implemented. At the event, a total of 18 teams from



9 countries competed with the team from Harper Adams coming second in Task 2, first in Task 1 and in third place overall.

- **Agnese Mancini** - received her MSc by Research in Land Reclamation and Restoration: Agnese is currently working towards a PhD concerned with cover crops for erosion and runoff control in forage maize with support from The Trust.

The Douglas Bomford Trust award for the best student on the Land Reclamation and Restoration course was presented to Danielle Whitlock.



Danielle Whitlock receiving the DBT Award from Trust secretary Paul Miller at the Graduation Prize Winners ceremony at Cranfield University.

AT THE ROYAL AGRICULTURAL UNIVERSITY

The Douglas Bomford Trust prize at The Royal Agricultural University is awarded for the best student project that links the application of engineering principles to agricultural applications.

This year the award was presented to Destiny Bradley for project work concerned with the automated monitoring of sheep using tri-axial accelerometers.

Destiny also won an award that gave her the opportunity to go to the Alltech Rebellion in Kentucky, USA in May and this she was able to do using her prize (a ticket for two that she shared with a fellow student and a contribution to travel and accommodation costs) together with a

top-up travel grant from The Trust.

A report of her trip is expected shortly.



Destiny Bradley at The Royal Agricultural University with Paul Miller, having received The Douglas Bomford prize

The effect of ground pressure on soil properties and crop development for 3 tillage systems

This research studentship in the Crop and Environmental Sciences and Engineering Departments at Harper Adams University, in conjunction with the University of Illinois at Urbana - Champaign, USA, is now open for applications.

The Michelin Tyre Company Ltd funds this project for a period of 3.5 years. The Director of Studies is Dr Paula Misiewicz, in conjunction with David White, Dr Ed Dickin and Professor Richard Godwin (Harper Adams University) and Dr Tony Grift of the University of Illinois, USA, where (after initial 3 - 6 months training at Harper Adams University, UK) the field studies will be conducted. It is anticipated that the final thesis preparation stage will be conducted at Harper Adams University (3 - 6 months).

Applications should be made through the Harper Adams University website: <https://jobs.harper-adams.ac.uk/> where further details of the project can be found. The studentship will start on 28 September 2015, with the exact starting date to be negotiated at interview. Interviews will take place at HAU for shortlisted UK applicants, and by Skype for shortlisted applicants from the USA and other countries.

Further information can be found on the HAU website at www.harper-adams.ac.uk and on the research training provided and PhD progression requirements in the Postgraduate Research Students Handbook at:

<http://www.harper-adams.ac.uk/research/files/MPhil-PhD-Handbook.pdf>

For informal enquiries on general aspects of research degrees at HAU, applicants may contact Mrs Viv Slann, Research Students Administrator (vslann@harper-adams.ac.uk). For informal enquiries on the project, applicants may contact the Director of Studies named above through the staff directory: <http://www.harper-adams.ac.uk/staff/photo-directory.cfm>

The studentship includes tuition and bench fees and a personal stipend of £16,456 (\$25,342); this is indicative and will be dependent upon the exchange rate at the time) rising with annual increments and including fringe benefits (US Health insurance). Applicants will normally be expected to hold a bachelor's degree with a first or upper second class or a high GPA in an appropriate subject and ideally a relevant masters degree, such as agricultural engineering/mechanisation, soil and/or crop sciences, and agronomy/agriculture.

A minimum level of competency in English is required. International applicants need to be classed as an overall IELTS grade 6.0 with a minimum of 5.5 in each component. Please see the University's web site at

<http://www.harper-adams.ac.uk/international/english-language.cfm> for English Language requirements.

REFERENCE -
PM-MICH



Too much or Too Little Water?

Landwards is very pleased to start presenting papers from this year's IAgrE Conference

Introduction by **MARK KIBBLEWHITE**,
IAgrE President



Our 2015 conference *'Too much or too little water? Engineering innovation for agricultural water management in a changing climate'* was motivated by a perceived need for engineers to focus more strongly on water management in agriculture.

The impending crisis arising from the nexus of increasing demand for water, food and energy, including the pressures from accelerating climate change, is much discussed and rehearsed by the media and academics - but the vital practical agenda is about driving technological innovation to increase productivity. Investment and innovation in field drainage and irrigation are essential for responding to the intense rainfall events and periods of summer drought that climate change is bringing, but they appear relatively neglected. The conference aimed to explore how these technologies are being and can be developed to increase resource efficiency.

CAROLINE DRUMMOND from LEAF provided a strategic context, highlighting that life and water are inextricably connected and that water security is about meeting the need for clean water and adequate food supplies but also protection from flooding.

She described how Integrated Farm Management is a tool to achieve a World that is farming, eating and living sustainably, with smarter engineering being a key to optimal management of green, blue and grey water use and recovery across the whole value chain, from farm to retailer to consumer.

Discussion on drainage was kicked-off by **DICK GODWIN**, who gave an authoritative and comprehensive analysis of the current position and trends in field drainage, explaining how drainage benefits the soil-plant-water system.

He emphasised the lack of recent investment in the UK not just in drain renewal and improvement but in ongoing maintenance of drains and ditches. As he said, "Restoration of an old system is cheaper than a new system." However, drainage infrastructure has a finite lifetime and much of that in the UK is falling down.

FRED CLARKE from Mastenbroek described state-of-the-art systems to design and install new field drainage, with data collected by drones to provide soil information that informs precise decision-

making about drain positions and generates locational data to control advanced trencher technology.

He also gave us a glimpse of future field drainage which may include buffers to moderate flow to catchments and intercepting bioreactors to remove and recover nutrients.

Envisioning an engineered soil landscape, designed as a system to support higher productivity and reduce environmental harm, is a persuasive concept and **ROB SIMMONS** showed how innovation is already achieving elements of this vision. He elegantly summarised the theory and practice of soil management to control excess surface water run-off and brought us right up-to-date with the current technology using cover crops, shallow tillage, mulches, grassed waterways and polymer application.

Irrigated agriculture is highly productive but uses water that is also needed to support growing urban populations. The challenge is to do better with less water and **JOHN GOWING** provided perspectives on the challenges of improving the performance of large scale irrigation systems in Africa and underlined that, "Faced with blue water scarcity we need to target increased productivity of green water".

The technology being developed and applied to production of higher value crops is highly advanced and **MARK ELSE** gave us a view of the cutting-edge, including real-time irrigation scheduling to improve not just yields of soft fruit but also their quality, via beneficial stressing and close attention to root development.

Reliable, robust, durable and accurate measurement systems are critical components for irrigation control and **JOHN NEWSTEAD** from Delta-T Devices described sensors and datalogging systems that have been demonstrated to consistently improve water use efficiency while reducing production costs, across Europe and the Middle East.

His presentation showed that the tools exist for the close management of the water-soil-plant-system through attention to its detailed performance and real-time adjustment.

Conclusions and key messages taken from the conference

Although the need for improved in-field water management is clear and urgent, there already exists a wealth of relevant knowledge and technology. The underlying science is known and many of the components for precision drainage and irrigation are available commercially now. The key problems are in the realm of systems engineering and that part of innovation that drives technology adoption.

A systems engineering approach is self-evidently required to optimise complex agro-ecosystems, including managing water via irrigation and drainage and for indoor production as well as field-based agriculture. The exciting prospect is that innovation in sensors, data management and analysis, delivery and control devices means that the level of control over water storage, movement and transfers can be very much better than in the past. This is a happy hunting ground for agricultural engineering.

Achieving a wide and effective adoption of the new technology for water management is perhaps more challenging than its development. Investment in agricultural water management, especially drainage, brings returns over the longer term and our current economic priorities are more short-term. If UK agriculture is to be more productive, resilient and less environmentally damaging, an industry water strategy is needed and substantial investment found to implement it. This strategy will need to recognise the key role of agricultural engineers and ensure proper investment in their professional education and training.



Integrating sustainable water management with sustainable food production

By CAROLINE DRUMMOND,
MBE LEAF CHIEF EXECUTIVE



SETTING THE SCENE

"We forget that the water cycle and life-cycle are one" -

Jacques Cousteau

Water has always been a key part of my life, as the daughter of a deep sea diver, I have always had a huge respect for water, its power, its wealth and its use.

If we look at the challenges we now face with increasing global population and urbanisation, rise in obesity and its related diseases as well as the huge pressure on our natural resources, water security is a huge challenge. The world's water resources are no longer to be taken for granted. Access to supplies has increasingly become a balance between water's use within economic activity, including agriculture's predominant role for human health and nutrition as well as landscape and amenity value.

In essence, we need to undertake the care and husbandry of water that this precious resource deserves. We have to look at innovative ways of ensuring the availability of an acceptable quantity and quality of water for health, livelihoods, ecosystems and production.

Globally, pressures on our water resources are having dramatic effects. Freshwater resources, such as lakes and

aquifers, which are usually naturally recharging, renewable resources are being over-exploited. We are living beyond the capability of our planet to restore itself.

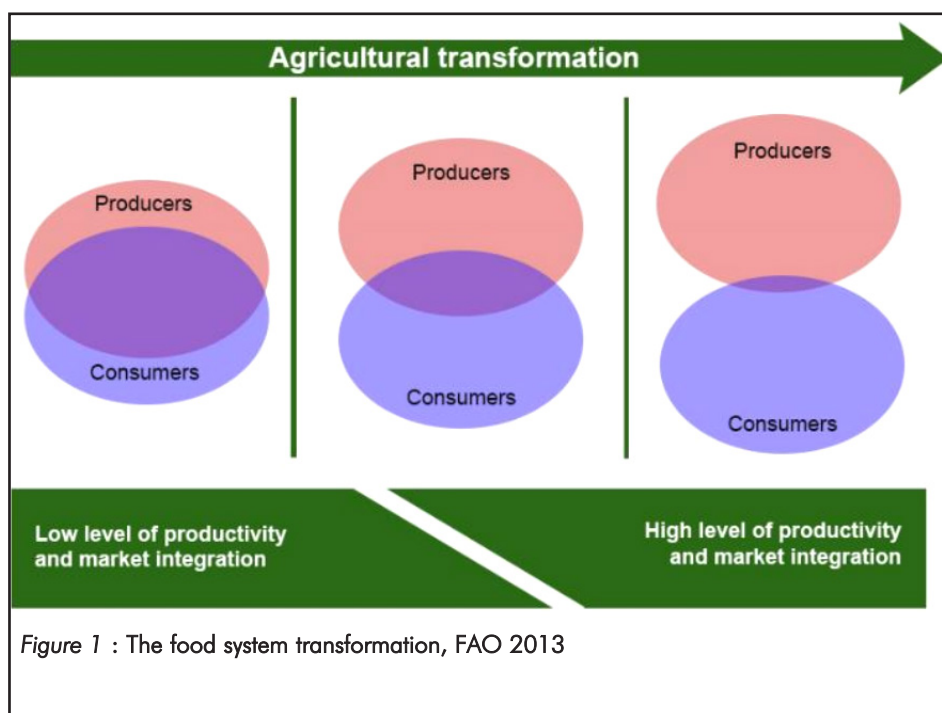
The good news is that the potential for savings, without harming human health, economic productivity or causing environmental degradation is vast. Improvements in water-use efficiency are possible in every sector.

More food can be grown with less water (and less water contamination) by shifting from conventional flood irrigation to drip and precision sprinklers, along with more accurate monitoring and management of soil. Conventional power plants can change from water cooling to dry cooling, and more energy can be generated by sources that use extremely little water, such as photovoltaics and wind.

By wasting less, polluting less, reusing more, managing effectively and becoming more efficient in all uses of water - individual, collective, agricultural and industrial - we can achieve higher water productivity levels and reduce water stress. Continued evolution of technology and infrastructure improvements will enhance water supply capacity for cities and industries, while helping deliver clean drinking water and sanitation services to rural populations and the urban poor.

But there is another threat to our global water resources, brought about by how our food system is transforming (*Figure 1 over*).

continues over



This demonstrates the transformation of the food system revolution, typically characterised by rising labour productivity and less people in agriculture and increasing urbanisation.

As the food system transforms, centralised food-processing facilities develop along with large scale wholesale and logistics companies; supermarkets emerge in the retail sector and fast-food restaurants become widespread. The transformation affects the whole system, changing the ways food is produced, harvested, stored, traded, processed, distributed, sold and consumed. Indeed, the rise in obesity across Europe is one very visible consequence of how our food system has changed. Added together, we are seeing huge pressures on the long term sustainability of our water resources.

INTEGRATED SOLUTIONS TO SUSTAINABLE WATER MANAGEMENT

At LEAF (Linking Environment And Farming) we look to address some of these challenges in a practical, realistic and achievable way through the promotion and demonstration of Integrated Farm Management (IFM) (see Figure 2).

Our vision is of a world that is farming, eating and living sustainably. By inspiring and enabling sustainable farming we enrich the environment and engage local communities.

For us, IFM is key to the delivery of more sustainable farming.

It is geared towards sustaining and optimising the use of all resources on farm, including soil, water, air, staff, machinery, capital wildlife habitats, and landscape features.

The implementation of IFM is all about adopting knowledge and innovation alongside beneficial husbandry principles and traditional methods. It is built around the development of a risk management approach to anticipate, assess, manage and develop contingency plans for any unplanned and/or natural resources. Water management is a central component of IFM.

Partnerships are key in making change happen for LEAF and this includes our members and farmers who are active in leading the way in innovative and informed approaches. We have some 40 LEAF Demonstration Farms and eight LEAF Innovation Centres who are proactive in sharing ideas, solutions and beneficial practices as well as new innovations and technology. This approach works well and creates a good discussion platform between farmers, researchers and industry to develop change.

Furthermore, building on their experiences and expertise we have developed a series of management tools such as the LEAF Sustainable Farming Review (formally the LEAF Audit), guidelines, metrics and indicators to monitor and evaluate impact.

Water management is a global issue, however the solutions must happen locally.

The challenge and opportunity for farmers is how to produce more food, using less water, whilst protecting its quality. The framework of IFM allows them to do just this. We have carried out extensive work with our farmers looking at ways to help them improve the performance, health and long term sustainability of their water resources.

This has included measuring key practices, developing management tools and on-farm demonstrations and carrying out a number of on-farm research projects looking at more sustainable water management.

We have also worked with Asda and Molson Coors in the development of

Sustainable farming, delivers a site-specific farming system supporting the integration of the environment, society and farm economic viability over the long term

LEAF 2012



Water management is a global issue, however the solutions must happen locally

'Simply Sustainable Water' - a practical booklet for farmers highlighting six simple steps to more sustainable water management covering:

- **Water Saving** - reducing water use where practical, reusing water where possible eg. treating and reusing water for washing down yards and dirty areas
- **Protecting Water Sources** - the principles of IFM can help farmers protect water sources and improve water quality, helping reduce the risk of run off from inputs, restore wetland areas and peat bogs and tackle over-grazing.
- **Physical Health** - Soil management practices such as consideration of topography, cropping plan, livestock grazing patterns and cultivation choice
- **Physical Health** - Drainage considerations to address waterlogging and flooding
- **Monitoring** - Tracking water use to assess water use and highlight areas of improvement
- **Water availability and sunshine hours** - making the best use of sunshine and rainfall to produce food at the required yield and quality.

The booklet has been well received by farmers and helps support practical ideas for delivering change. Predicting the unpredictable is a growing challenge. Being able to effectively manage water especially when you are not irrigating can be difficult. This is where practices such as good soil management and the use of new technology are absolutely critical within the IFM approach.

But the pressures and drivers for change for farmers include increasing regulation, volatile weather patterns and customer requirements. These all add to the need to ensure that farm businesses are fit for purpose.

The attention to detail and the site-specific nature of IFM provides an effective framework for farmers to deliver a change. It is LEAF's IFM approach that has been

the foundation for the development of the environmental standard on food, the LEAF Marque.

It is a globally recognised food assurance system recognising products that have been sustainably produced. And it is being increasingly adopted, with some 25% of UK's fruit and vegetable crop area being LEAF Marque certified.

The development of LEAF Marque and its use by retailers such as Waitrose, Florette, and many small independent businesses is providing farmers with the opportunity to be recognised in the market place for their environmental credentials. Indeed, Unilever now adopt the LEAF Marque as part of their procurement plan which is to ensure that 100% of their raw materials are sustainably sourced by 2020.

Specifically, in the UK this has been on oilseed rape that is destined for Flora margarine and Hellmann's mayonnaise.

With the advances that are taking place in farming, public engagement is essential. This is also a significant part of LEAF's work. In the future farmers will need to make some hard decisions. Ensuring the public know why these compromises are having to be made will be critical.

Since LEAF started in 1991 public engagement has been central to our work - through LEAF Demonstration Farms, LEAF Innovation Centres and Open Farm Sunday, which has seen some 1.6 million people visit a farm over the last 10 years.

However, we have already seen a grow-



Figure 2: LEAF's Integrated Farm Management Framework

ing public concern surrounding technology, such as with GM and neonicotinoids and it is critical that we engage the public, understand their concerns, debate the issues and bring them alongside.

Never before has there been such an important opportunity for farmers and engineers to work together to really exploit the level of change required for more sustainable farming systems.

The opportunities are huge, but time is short. We need to deliver resilient farming systems, with improved yields, returns and ecosystem services. We need to demonstrate the importance of change with better public engagement and develop stronger partnerships both within and outside the industry.

Smarter engineering will be key - members of the Institution of Agricultural Engineers are well placed to identify opportunities and accelerate changes towards more sustainable farming systems across the globe.

Precision sensing and control for improved water use efficiency



By Dr JOHN NEWSTEAD,
Soil Scientist and Technical Sales Engineer at
Delta-T Devices Ltd

Precision sensing and control for irrigation is all about directing water where it is needed, when it is needed and in the quantities required.

These techniques have also allowed the controlled stressing of plants and fruit by using deficit irrigation and partial root zone drying to control growth, quality, shelf life and sugar production. Potentially

these techniques lower water usage, reduce fertiliser losses and environmental pollution and can benefit the bottom line for a commercial operator.

With the added driver of increasing legislation on water use, such tools to improve our water use efficiency are becoming increasingly common.

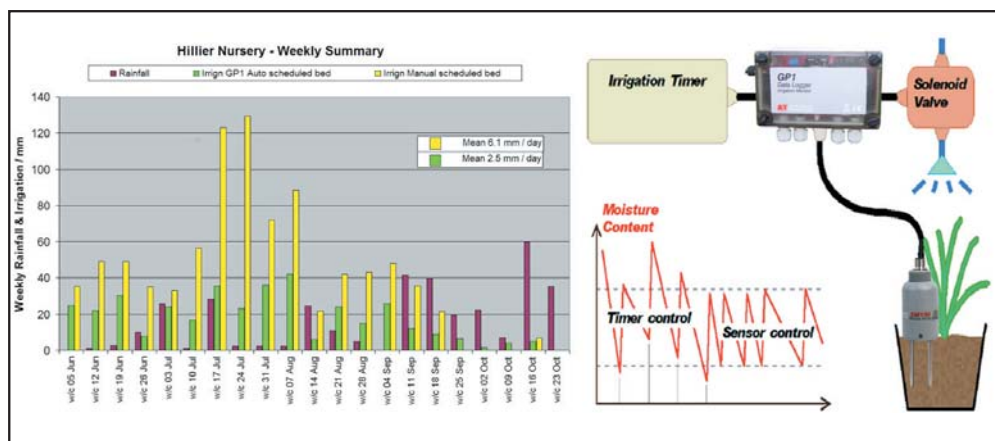
One early Delta-T project with Hillier

Nurseries used a GP1 data logger and controller with a soil moisture sensor to control irrigation for a range of ornamental plants. This system delivered a 60% saving on water usage when compared to the standard practice of timed irrigation to produce the same product.

The logger monitored the output of the soil moisture sensor and when this dropped below a predetermined threshold the logger switched the irrigation system on. When the soil moisture reached an upper threshold the logger switched the irrigation off. Meanwhile the moisture content was maintained at optimal levels for the crop.

It does not matter if it is a hot or cold day. The logger will simply trig-

Hillier Garden Centre Study (2006) using threshold values to determine when to irrigate. Simple control from representative pot saved 60% water (green bars) compared to the control plot to produce the same product (yellow bars).



ger fewer irrigations on cold days and more frequent irrigations on hot days. A saw tooth pattern results, with the water content maintained at the optimum for that crop. Over-watering and under-watering events were also eliminated. Simple, practical and effective.

There are also the benefits of less labour, lower pumping costs and often plants that are better shaped and require less pruning and maintenance. Similar results were repeated by Else (2013).

Some large scale farm projects tested the scalability of such simple logger-sensor arrangements, this time also adding teniometers to the GP1 data logger and soil moisture sensor combination.

'Flow-Aid' trial farms were located in The Netherlands, Italy, Turkey, Lebanon and Jordan (Balendonck *et al.*, 2010). Despite different crops and irrigation technology being used, water savings of 17 to 68% were achieved, often associated with increased yields, reduced leaching and fertigation losses. The resultant crops were also often judged to be of better quality than before. In fact, at the end of the project a neighbouring farmer at the Turkish site was switching his irrigation on when the project farm was irrigating! From a commercial perspective, when the bottom line is affected most people pay attention.

Further efficiency improvements in precision irrigation techniques have been achieved using the new programmable GP2 data logger and controller which can have up to six relays to control six physical actions such as irrigations, fertigations, salt flushes or to trigger alarm messages.

If you have an environmental parameter that can be characterised by an algorithm then it is possible to store it in the GP2 logger using its Script Editor function and as long as you have the correct sensors attached you can output the resultant calculated property. For example, a study by Soga *et al.* (2014) involved the implementation of a complex slope stability equation into the GP2 DeltaLINK software that linked rainfall to a slope safety factor.

Delta-T Devices has applied this functionality in programming novel PID programming into some of its irrigation projects (Goodchild *et al.*, 2015).

PID is a control process usually found in industrial fridges and heaters. They are set to a target value rather than upper and lower thresholds. The feedback is constantly being analysed in relation to this target value using Proportional, Integral and Derivative algorithms (PID).

This technique allows for even tighter control of irrigation around a single target value - potentially important for high value crops. The proportional component looks at the actual return signal value in relation to the target, the integral looks at the trend of the signal and the derivative, the rate of change of the signal.

All the components can be weighted and appropriate alarms or events triggered if needed. Unusually for a data logger, the control values can actually be changed whilst the logger is recording, speeding up the monitoring and control process.

Another benefit to PID control of irrigation is its ability to respond quickly to environmental changes during the diurnal cycle.

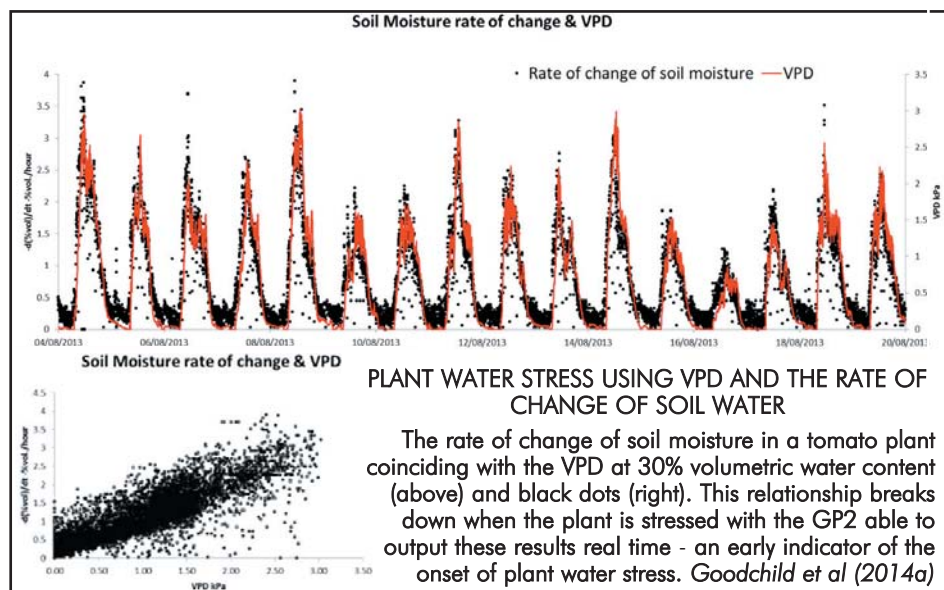
Tests on polytunnel tomatoes using a

GP2 data logger with evaporation and leaching losses minimised, clearly showed the relationship between the rate of change of soil moisture, measured using the Delta-T SM300 soil moisture sensor in the root zone, with the real time calculated vapour pressure deficit (VPD) measured in the plant canopy (Goodchild *et al.*, 2014a).

VPD is often described as an environmental driver. A high VPD means high plant water loss. Tests showed that when water in the substrate was not a limiting factor the VPD and rate of change soil moisture curves mirrored each other.

When water was a limiting factor the relationship broke down. Determining the rate of change of soil moisture was calculated using the GP2 logger as was the VPD with appropriate sensors attached. The possibility has been raised that this real time live output from the data logger could be used as an indicator of the early onset of plant water stress in the field, polytunnel or laboratory.

Further studies have applied the PID/GP2 control to the maintenance of soil water potential as external environmental drivers change. This is a level of control that has until now been hard to achieve.

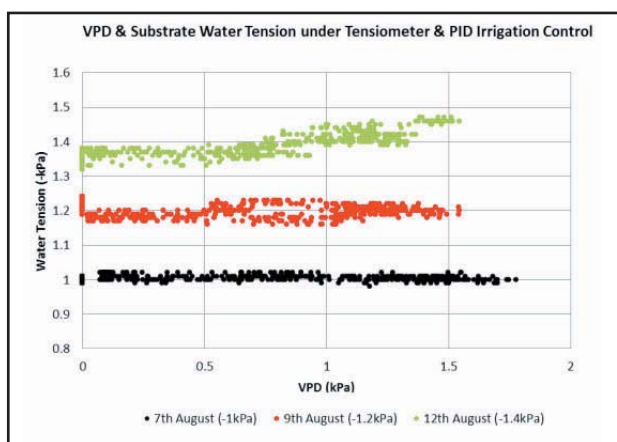


LEFT:
GP2 data
logger



SM150 kit - one of a range of soil moisture kits available that are robust, easy to use and accurate. These sensors can also be buried and attached to data loggers for continuous monitoring of subsurface water changes.

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Prototype patented dielectric tensiometer, currently undergoing field trials.



commercial substrate strawberry production: AHDB report, SF136

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- Soga K., Goodchild M., Jenkins D. and Kühn K. (2013) *Implementation and evaluation of a slope stability equation performed with the Delta LINK simulator.* Poster available for free download via www.delta-t.co.uk.

Delta-T Devices is a co-operative business based near Cambridge, that for over 40 years has designed, manufactured and sold soil, plant and atmospheric monitoring equipment.

For further information please contact
Dr John Newstead on
john.newstead@delta-t.co.uk or
martin.goodchild@delta-t.co.uk.

In addition, use of the Script Editor in the logger has allowed simple temperature compensations to be made for soil moisture sensors.

It is well established that the dielectric constant of a soil, which correlates to volumetric water content, varies with external environmental changes, particularly changes in temperature. In tests this can be in the order of a few percent which may be important especially in high value crops.

A correction based on the CRIM equation can be applied which mitigates this effect and again allows for more detailed water use efficiency and irrigation planning (Goodchild et al 2014b).

A recent development that has implications for water resource improvements and project planning and implementation in particular, is the use of the Simulator application available for free with the DeltaLINK software which runs the GP2 data logger (Goodchild et al., 2013).

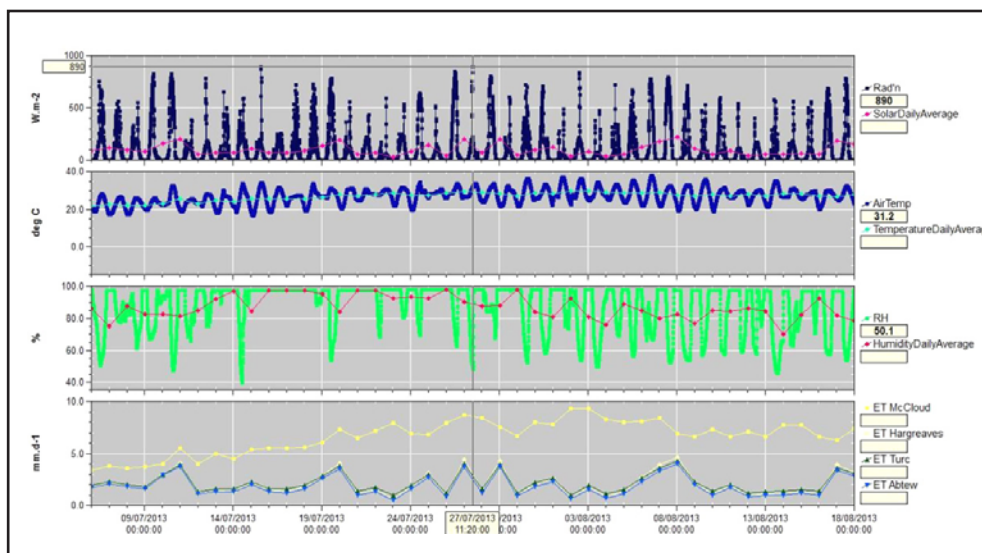
This Simulator allows the operator to check programme validity, refine irrigation or other control conditions prior to real time activation, evaluate irrigation or ET model performance and makes a superb

teaching aid as it can be used in the classroom.

At a variety of scales and using a variety of technologies, precision irrigation techniques are able to improve water use efficiency and plant and fruit quality. They are able to contribute to our understanding of soil-plant-atmospheric interactions whilst on a commercial basis these techniques have proven to boost the bottom line. Currently Delta-T Devices is involved in 7 collaborative Innovate UK projects where these techniques are being variously employed to monitor and evaluate for commercial application on large and small scale trials.

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- Else, M. (2013) *Improving water and fertiliser use efficiencies and fruit quality in*



HOW DO SIMPLE ET ALGORITHMS COMPARE WHEN RUN AGAINST MARITIME CONTINENTAL CLIMATIC DATA USING THE GP2 DATA LOGGER SIMULATOR?

As some growers and researchers use evapotranspiration (ET) as a means to determine when to irrigate, choosing which ET programme to use can be far from clear. This simulation compares three simple published ET equations. Three of them follow the same line, whilst the fourth is somewhat different. Such comparisons whilst being good teaching aids also allow the researcher to refine their project aims and needs. (Goodchild et al 2013)

IAgrE Guild of Agricultural Journalists award winner



Alastair Taylor presents the award to Andy Collings

The article presented here by Andy Collings won this year's IAgrE Guild of Agricultural Journalist award.

First appearing in *Profi* magazine, the judging panel commented that the article contained good, sharp facts throughout and took a technical topic and explained it in a clear and understandable way for all readers. It was also felt Andy had made a difficult subject accessible and appealing to a large number of readers.

The competition is run annually to find the best articles/broadcasts that highlight the vital role of engineering in meeting the requirements of modern food and energy production and is open to members of the British Guild of Agricultural Journalists.

Alastair Taylor, IAgrE CEO, said, "This award helps us to showcase what engineering is capable of and how much progress is being made. We were delighted with the response to this year's competition and the judges had a very difficult task choosing this year's winner."

The cheques and a commemorative plaque for the winner was presented at the Guild's Bangers and Beer reception held on the first day of Cereals earlier this year.

The brains behind the operation

By ANDY COLLINGS

High-tech electronic control systems play a major part in the operation of today's diesel power plants. Where engine adjustments were once made using spanners, screwdrivers and no small degree of guesswork, modern motors now rely on sensors and computers. We take a look at the role of the ECU - the engine control unit.

Over the past couple of decades, the design of diesel engines has been subjected to dramatic change - not so much as to how an engine works, but more in the way its main components are controlled and fine-tuned to maximise power, fuel economy and comply with ever tighter emission regulations.

And while most of us can get our heads around the advantages offered by common rail fuel injection systems, turbochargers and electronic cooling fans, there remains a host of inter-reactive control systems that help these components and many more to achieve greater levels of efficiency.

But to start with, a very brief look back to remind ourselves of the inner workings of a diesel engine if only to be able to fully appreciate and understand how the use of

electronic management has helped to achieve the performance levels we now expect from modern motors.

The diesel engine is a compression ignition engine that uses pistons to compress air in the cylinders to raise the temperature of the air to the point where it can ignite the diesel fuel injected into the top of the cylinder. A typical compression ratio would be somewhere between 15:1 and 22:1 and this would result in a cylinder head pre-ignition pressure of about 40 bar and an air temperature of 550°C. When turbocharged, cylinder pressure can be as high as 150 bar and the temperature generated can climb to 900°C - significantly higher than the ignition point of diesel, about 250°C.

Getting the fuel into the cylinder at the correct time and in the required volume was to prove to be a taxing problem with

continues over

early diesel engines which, after several different designs, settled on a mechanically driven in-line pump that employed a series of small high pressure pumps to deliver measured amounts of fuel to the cylinders.

It is fair to say that the diesel engines in the early years were heavy, slow running, noisy and perhaps only slightly cleaner to operate than a coal-fired steam engine, but when compared to old gasoline engines they were vastly more efficient and, when running, probably more reliable.

There was, however, plenty of room for improvement and, with the introduction of common rail fuel injection, turbochargers and inter-coolers, fuel efficiency improved along with an increase in torque output. But one of the biggest drivers in modern diesel engine development has been the demands inflicted on manufacturers by mandatory exhaust emission reduction requirements. As we shall see, designing an engine that complies with these stringent requirements has meant even greater demands also being placed on electronic engine management systems.

At the heart of the electronic management system is the engine control unit (ECU), which is in effect a pre-programmed computer (the buzz word is 'mapped') having the ability to react to operational changes within the engine in terms of fuel injection, temperatures, cylinder pressures and so on - the whole package.

The unit, which needs to be sufficiently robust to provide the required reliability while working in what can be hostile conditions, receives its info from sensors placed within the engine.

First, then, a look at how electronic engine management scores with common rail fuel injection, and what is required of it. For starters there needs to be a system to monitor and maintain the pressure in the fuel reservoir, which is the common rail where fuel pressures can be as high as 2,000 bar. A sensor monitors fuel pressure and feeds information back to the ECU, which then activates the high pressure pump to maintain the pre-set pressure.

Injectors are opened and closed by either solenoid-activated valves or by the increasingly popular piezo-operated valves that are used by the very latest diesel engines.

Anyone who has owned a gas lighter that

ignites when a lever is squeezed will have drawn on the effect caused when certain crystal material is compressed to produce electricity - piezoelectric. Reverse the effect and add electricity to the crystal and it rapidly expands albeit by a small amount. However, with sufficient crystal slices stacked together the movement is sufficient to open the injector valve and shut the instant the electricity flow is shut off - a much faster opening and shutting cycle that allows accurate and numerous injection pulses to take place.

It should be noted that the timing of fuel injection has a big effect on emission levels and fuel consumption. If the fuel is injected when the piston is still rising, efficiency is reduced and extra fuel is used; and if injection is too late, torque is reduced and there will be extra emissions caused by incomplete combustion.

One of the key tasks for the ECU, then, is to provide a sequence of timed fuel injections rather than just the one injection for each combustion cycle. There are normally three different modes, though this

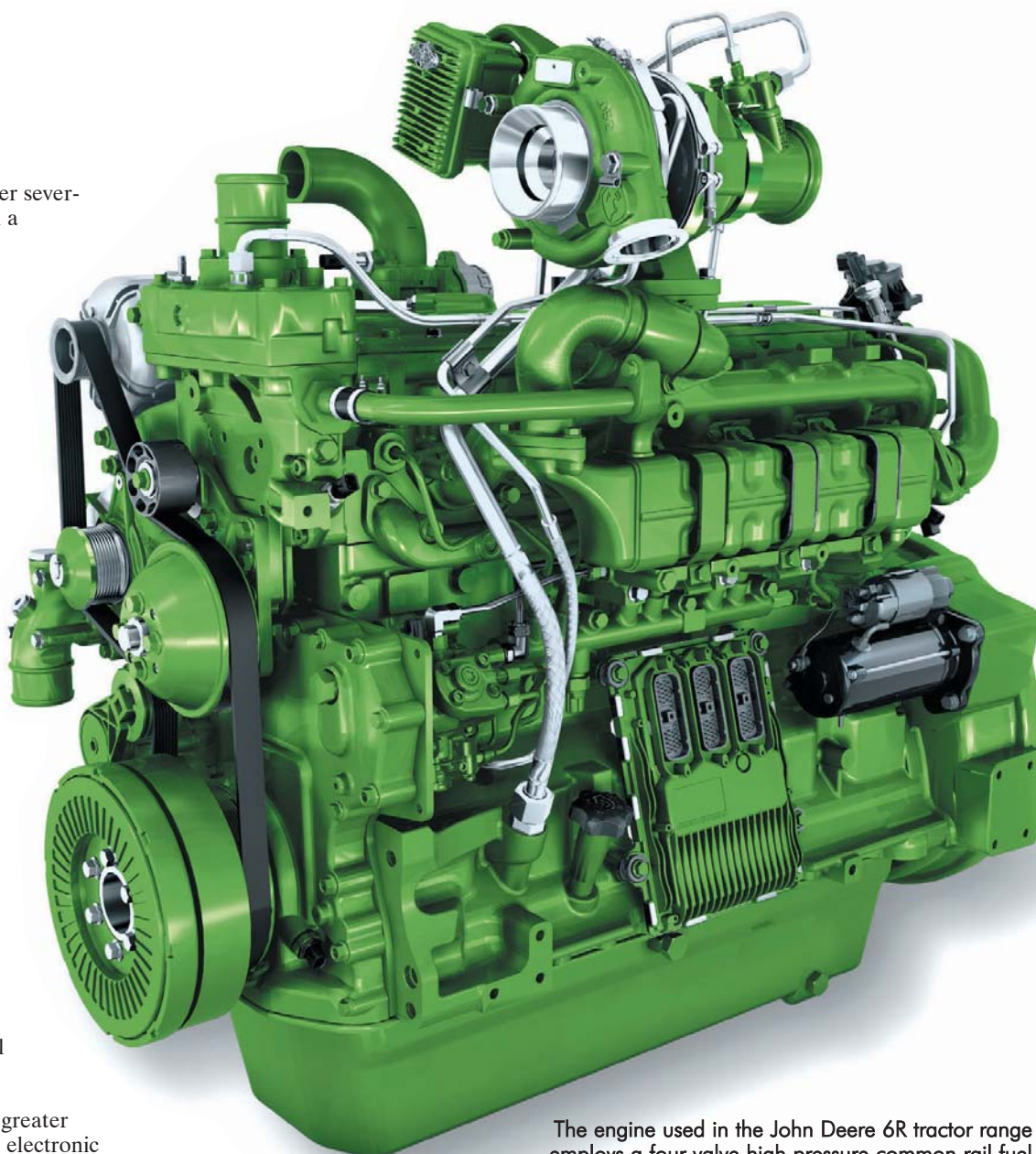
The engine used in the John Deere 6R tractor range employs a four valve high pressure common rail fuel injection system which operates at 2,000 bar pressure and works in conjunction with a variable geometry turbocharger designed to provide the correct amount of boost. NOx emissions are reduced by the engine's Exhaust Gas Recirculation system.

can vary with engine design, with the trend now towards fewer rather than a greater number of fuel injections.

The first is pre-injection, a short pulse of fuel that has two effects: it reduces combustion noise and it also reduces NOx emissions. This is followed by the main injection during which the bulk of the fuel is delivered. The final phase, the post-injection reduces soot emissions. Using huge injection pressure means the fuel is atomised and, as a result, can have access to a greater volume of oxygen in a smaller period of time.

Those impressed by precision will need to know that fuel amounts can be as low as just one cubic millimetre for pre-injection rising to 50 cubic millimetres for the main injection phase - and the duration of an injection is normally 1-2 milliseconds. The key aim is to get the fuel and air together as fast as possible.

Clearly, it's a tough job being a fuel injector and it has been estimated that dur-



“The timing of the fuel injection has a big effect on emission levels and fuel consumption”

ing its working life it will have opened and closed over a billion times.

All of which is pretty heady stuff but the ECU has a lot more to contend with when it comes to calculating how fuel is used - it has to 'know' the engine speed, crankshaft position, the boost pressure, engine coolant temperature and oxygen levels which vary with operating altitude and ambient temperature. Provided by sensors, this information is utilised by the ECU to compute fuel injection timings and duration so that engine efficiency is maximised.

A point to note with diesel fuel systems is that while we still tend to call the 'go-faster' pedal/lever the throttle, it has no direct control over the quantity of fuel injected; its movement is now considered to be a request for more or less torque which, when selected, will be maintained by the ECU through automatic changes in fuel quantity made as loads change.

The demand for more power is not answered simply by increasing the amount of fuel injected (up to the 'smoke limit') but also by increasing the volume of air produced by the turbocharger which, by definition, has a response time slower than the injectors. To reduce excessive fuel being fed to the engine and an inappropriate air/fuel ration being created, the ECU provides a fuel increase at a rate that allows the turbo time to spool up sufficiently.

With the engine running it's time for the tractor to do some work.

When using a basic mechanical gearbox it is the operator who makes decisions regarding gear selection, whereas a step-less transmission opens up new opportunities of optimising fuel efficiency with ratio selection and sustaining engine speed for pto operation. One conundrum is that best efficiency and best power never occur at the same point.

The best fuel efficiency will normally not be at near-maximum torque 'wide open throttle', but at some intermediate engine speed - typically somewhere around half maximum engine speed; this is because frictional losses increase significantly with engine speed. Maximum power will nearly always be at the highest engine speed, but with a fuel economy that is perhaps around 25% worse.

ECU AND EMISSION CONTROL

It's time to turn our attentions to exhaust emissions and the important part the ECU plays in ensuring emissions are suitably controlled - not that designers haven't already made big strides in this department through the way fuel is delivered to and combusted in the cylinders, the design of the combustion chamber, tiny fuel droplets, four valves/cylinder and, as we've noted, accurate engine speed control, measured fuel, timing, high injection pressure, temperature and air/fuel ratio sensing, all of which help to decrease NOx and hydrocarbons.

But with demands now as low as they are, designers have had to look for other

systems to help reduce particulates and NOx emissions and meet required standards. And this has imposed further duties on to the hard-working ECU.

Exhaust gas recirculation (EGR) allows a proportion of the exhaust gas to be mixed with the intake air, an action that reduces NOx emissions by lowering the concentration of oxygen in the combustion chamber. This, in turn, reduces the peak temperatures during combustion, which largely determines the NOx levels.

For those who may struggle to understand the effect of EGR, the easy way is to consider an 'opposite' - oxy-acetylene welding and cutting where, to increase combustion temperatures, all the nitrogen from the air has been removed so that the

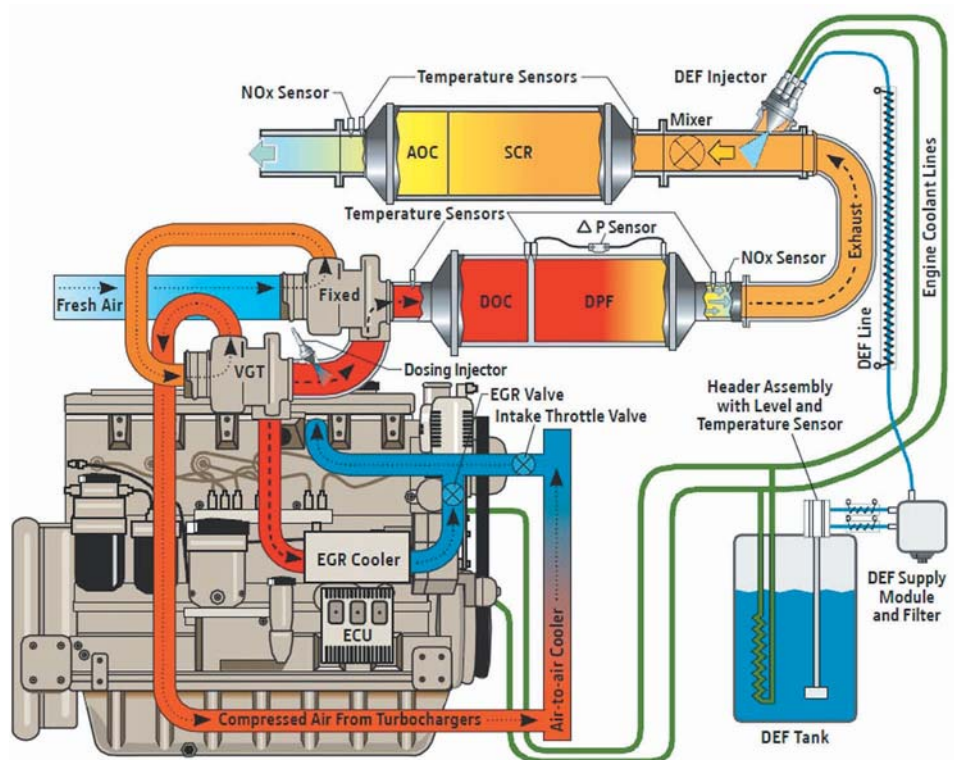
PowerTech PVX engine performance, John Deere 6210R



- Power (kW)
- Power (kW) with IPM
- Torque (Nm)
- Torque (Nm) with IPM

The ECU works to create the best possible delivery of power. John Deere calls it Intelligent Power Management.
Graph: John Deere.

PowerTech PSS Final Tier 4 technology



Stage IV - Deere's Integrated Emissions Control system, which draws heavily on the ECU, comprises cooled exhaust gas recirculation, an exhaust filter with diesel oxidation catalyst (DOC) and diesel particulate filter (DPF), and then a selective catalytic reduction (SCR) canister and an ammonia oxidation catalyst (AOC). Urea is injected into the exhaust stream to reduce NOx. Note the high number of sensors that feed information back to the ECU.

fuel/oxygen reaction doesn't have so much 'dead' gas to heat up. In the case of EGR, a greater quantity of dead gas, nitrogen and carbon dioxide is allowed to dilute the inlet air.

To control the system there is an EGR valve that is electronically operated. When the engine is idling, the valve is closed to prevent any exhaust gas flow into the manifold, but, when the engine is warm and operating under load, the valve is opened and allows exhaust gas into the intake manifold - the actual volume controlled by the ECU in respect of changing engine loads.

When peak torque is required, the EGR loop is closed, since power from the engine is ultimately limited by the quantity of oxygen available. But at other conditions, EGR reduces NOx, up to a limit at which excessive soot is produced.

Now in common use are Diesel Particulate Filters (DPF) which, made from porous ceramic materials, filter out particulates from exhaust gases. These filters are very efficient and operate at all temperatures, from cold start to maximum power. Some types take advantage of the fact that NO₂ can oxidise soot at low temperatures (250°C) - the 'continuously regenerative trap'.

For most systems, however, soot gradual-

ly builds to a point that pressure sensors on the inlet and outlet indicate a soot quantity that should be removed, and the ECU then instigates a regeneration process. This requires a temperature of 600°C, which can be created by adding a fuel injection pulse late in the cylinders' working stroke, resulting in a very hot exhaust gas.

NOx control by after-treatment is becoming necessary, and there are many different systems coming to market. They can be split into 'batch' and 'continuous'. The former consist of chemical NOx traps that have to be occasionally regenerated by exposing them to 'rich' components - typically fuel injected into the cylinder at the start of the exhaust stroke, which would be impossible with older mechanical injection systems.

The latter is usually called Selective Catalytic

Reduction (SCR), which relies on a Diesel Exhaust Fluid (DEF) urea solution, better known as AdBlue. These set-ups are increasingly employed by tractor engines as a means of reducing NOx emissions. The additive is metered into the exhaust at a rate set by the ECU and is thermally converted to ammonia, which reacts with NOx in the presence of a catalyst to form nitrogen and oxygen.

There is further work for the ECU when it comes to diagnosing engine faults - faults flagged up if a sensor reading is deemed to be too low or too high for its given monitoring task. For more technical diagnosis, dealer mechanics are now issued with computers that can be plugged into ECU units to help with the identification of engine faults, and there is a trend towards remote diagnostics, which allow modern engines to be monitored from afar.

SUMMARY

The ECU has a busy time, and it's reasonable to assume that without it the modern diesel engine would struggle to start and operate with any degree of efficiency or, in respect of emission compliance, legally.

Over the years the reliability of ECUs has increased to the point now that they have become an accepted, if not totally understood, component of a modern tractor.

The ECU is not just about emission control; it also has a host of other duties to perform in and around the tractor - accelerator pedal, engine speed, transmission, temperatures, fan control, cruise control, speed limiting, hydraulic control, pto speeds...The list is long, and it's fair to say that there are few elements within a modern tractor that are not now monitored by the ECU.



FARM SAFETY WEEK 2 15

AN UPDATE BY ALAN PLOM

Member of the Farm Safety Partnership (FSP) Board, chair of FSP Machinery Safety Group, and Vice Chair of the Institution of Occupational Safety and Health (IOSH) Rural Industries Group

Members should be well aware that agriculture continues to create the highest rate of fatal incidents and hopefully you will have heard (and read) about this year's *Farm Safety Week* (FSW), eg through IAgRE's Tweets or in the farming media.

This year's FSW ran between 6 and 10 July under the pertinent slogan, '*Don't learn safety by accident*'. It focussed on a different topic each day with case studies featuring individuals sharing their often horrific experiences and the terrible long-term consequences of serious incidents involving themselves or members of their family.

This was the third Farm Safety Week initiated by the Farm Safety Foundation (FSF), a charity set up by the NFU-Mutual. It was supported by all five of the national Farm Safety Partnerships (in England, Northern Ireland, Ireland, Scotland and Wales) as well as the national Regulators, ie the Health and Safety Executive (HSE) for England, Scotland and Wales, HSENI in Northern Ireland and the Health & Safety Authority (HSA) in Ireland.

This article provides an update and some ideas for future involvement and potential contributions by agricultural engineers to help reduce the terrible toll of deaths, injuries, suffering and ill health in this most dangerous of industries.

Topics covered during the Week included the most common killers, ie Falls, Machinery, Transport and Cattle, as well as Child Safety. Themed help and advice was

fed to the media and placed online each day by the Foundation.

Recent publicity from the Foundation [<http://yellowwellies.org/about/>] has been characterised by their distinct image of yellow wellies, and asking farmers the question '*Who will fill your boots?*' (in the event of an accident or death).

The Foundation identified young persons as their primary target audience and have been working closely with Colleges and making effective use of social media (including the adapted rendition by the Wurzels of their '*I've got a brand new combine harvester*' ditty! Information on the *Yellow Wellies* campaign is available via Facebook [www.facebook.com/yellowwelliesuk] and Twitter [twitter.com/yellowwelliesuk].

Detailed articles providing further information on each of the Week's themes, including other relevant incidents, court cases and links to related guidance, were posted each day by myself on the IOSH Rural Industries Group News webpage [www.iosh.co.uk/en/Membership/Our-membership-network/Our-Groups/Rural-Industries-group/Group-news.aspx].

I also decided that as farming is a 24/7 industry, the campaign should be extended into the weekend, so additional information was posted on occupational health risks, including links to guidance issued by IOSH to support its '*No Time To Lose*' campaign raising awareness of causes of occupational cancer. These include asbestos, diesel fumes and solar radiation - all relevant to anyone involved in agricul-

tural engineering too.

Finally, on the seventh day, useful guidance was issued on dealing with accidents and how to call the Emergency Services using SMS Texts - even when there is an inadequate signal for voice communications. This could be relevant to any of you, especially when working in a remote location - or find yourself needing emergency help at any time.

IAgRE SUPPORT AND INVOLVEMENT

IAgRE is a member of the FSP (England) and many of our members have contributed to the work of the separate national Partnerships over the past couple of years.

For example convening the IAgRE Conference on Machinery Safety '*Agricultural Engineering and Compliance - Thorn in the side or competitive advantage?*' at Harper Adams in March 2013, and participating in the FSP Workshops on Machinery Safety (October 2013) and Safe Handling of Cattle (October 2014).

IAgRE'S HEALTH & SAFETY TECHNICAL GROUP (HSTG)

More information on these events (including some of the presentations) is available on IAgRE's new HSTG webpage [www.iagre.org/brgp/31].

This Group was set up to enable and encourage ideas and good practice to be shared throughout the wide profession of Agricultural Engineering. In particular, to identify topics and opportunities for IAgRE members to make a positive contribution -

continues over



individually or through their businesses or organisations.

This is something which we must all take seriously and take action - from students and those just starting out in their career, to the most experienced members. We can all use our influence in our own spheres to identify and prevent dangerous practices. It is not just about designing out hazards in machinery or installing safe plant and equipment.

Most of us can recall seeing dodgy methods of work when out on site, e.g. inadequately guarded machinery being used or undergoing maintenance with guards removed; working at height without adequate precautions to prevent persons falling through or from roofs, etc; or working near overhead power lines.

These all feature regularly in accidents - and lead to prosecutions. Apart from the terrible injuries and suffering of their families, new guidance to the Courts mean that potential fines and prison sentences will increase significantly for employers and others too. Some of the incidents and Court cases reported in the IOSH articles have involved Ag engineering companies.

So, please don't just turn a blind eye and walk past anyone at risk of injury - or someone might actually end up with a blind eye - or worse. It is not easy to live with that on your conscience.

SO WHAT CAN WE (YOU!) DO?

Remember this is not just about machinery, but HSE recently pointed out that 200 people were killed in machinery-related incidents between 2004 and 2014 - nearly 50% of all fatalities in agriculture.

HSE's analysis revealed that:

- 124 people were killed during workplace transport (*nb.* HSE's statistics do not include incidents on the road).
- Contact with machinery resulted in 35

deaths - although many more injuries occur (and many remain unreported, including serious injuries).

- 29 of these 35 deaths occurred during maintenance - either planned, during a breakdown or while clearing blockages (ie under power).
- Almost every type of common agricultural machine was involved in a fatal accident - the most common being round balers (6), chainsaws (5), feed mixers (3), potato harvesters (2) and combines (2). (Several of these have been involved in further deaths since).
- A further 25 people were killed by being struck by machinery or something falling from a vehicle or machine - including 5 struck by trailer tail gates, 5 by loader arms and 4 by loader buckets.
- 8 people were killed as a result of machinery contacting overhead power lines (OHPLs). (*nb.* There are also tens of thousands of damage-only contacts and near misses - often cutting off the electricity supply to thousands of homes and business premises in the area, causing substantial economic losses, in addition to the cost of repairs).
- Of the 124 workplace transport deaths - tractors, ATVs and telehandlers accounted for 88%.
- 64 people were run over, 37 by their own vehicle! This is often due to the driver leaving the vehicle whilst it was in motion, starting the vehicle from an unsafe position, or working near a vehicle without applying the brake (or the brake was defective).
- 55 were killed in overturns - 25 tractors, 24 ATVs, 3 ride-on mowers, 2 4x4s and 1 telehandler - wearing the seat belt (when fitted, e.g. in a cab) at all times is vital.
- Road Traffic Accidents involving tractors or other farm vehicles are also a signifi-

cant cause of deaths and injuries - often to other road users, e.g. when farm vehicles are exiting or entering tracks or fields. (*nb.* These are investigated by the Police, not HSE, but it is apparent that these incidents could often equally have happened on the farm due to defects in the equipment (eg brakes, wheels and tyres, broken drawbars, etc.)).

HSE's conclusions and recommendations to improve Machinery Safety:

- We should (all) continue to promote Safe Stop.
- Machinery maintenance is a key problem area, where Safe Stop is particularly relevant.
- Persons using machinery are often using it in ways not foreseen by manufacturers and we need to consider the extent to which manufacturers should address these issues.
- Contact with OHPLs is the biggest cause of electrical fatalities and we need to promote good practice.
- Falls, i.e. when using machinery as an unsafe means of access, or falls from machines - also needs to be considered.

SAFE STOP

Details of incidents involving many of these machines or activities are described in the IOSH articles.

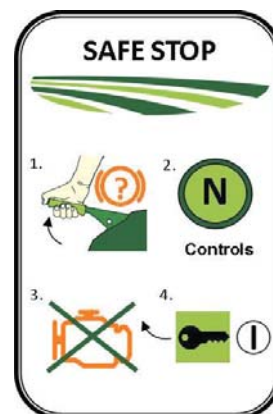
Many of these reports highlight the need to promote and follow the simple 4-step procedure described in the FSP's *Safe Stop* campaign

[www.nfuonline.com/business/farm-safety/farm-safety-partnership/campaigns/safe-stop/].

Self-adhesive Safe Stop stickers are now available in the form of a Handover Sheet. These include background information explaining

why the Safe Stop procedure should be followed, as well as describing the procedure itself. They are intended to be used as part of training or in Tool Box Talks, for example. (*nb.* The FSP want to make these more widely available so if you are interested in obtaining copies or (preferably) sponsoring or arranging printing, please contact the FSP Secretariat, using the online form [www.nfuonline.com/business/farm-safety-partnership/contact-us/],

However, it is apparent that we need to find new ways to tackle this problem, par-



ticularly to protect operators whilst machinery is being cleaned or maintained under power. Although manufacturers usually comply with guarding and other requirements specified in the Machinery Safety Directives and relevant EN standards, and provide clear instructions in manuals and signs saying 'Don't do it', many operators still fail to follow the Safe Stop procedure at all times.

For example, machinery is often left under power during cleaning or clearing blockages. This might be simply for convenience and to save time, but it is recognised that some machines or devices must be kept under power, e.g. to maintain pressure in control systems. Such operations are foreseeable and the many incidents which continue to occur indicate that we need to find new ways (e.g. remote or automatic methods) to clean or unblock machinery without exposing operators to the danger of entrapment.

Consider the other hazards highlighted above. For example simple precautions could prevent many transport-related incidents. The risk of a collision is even greater with large and long vehicles such as telehandlers reducing visibility. Planning safer traffic routes or developing new approaches for warning signs could make this operation - repeated countless times each day - much safer.

One simple suggestion is for automatic electronic signs to warn road users (like 'slow down' signs near schools) advising that a farm vehicle is approaching an exit onto the road?

Perhaps the above discussion or incidents described in the articles published on the IOSH Rural Industries Group news pages highlighting other non-mechanical hazards, e.g. related to handling livestock or storage of slurry, working at height, etc, might inspire you to come up with an idea worthy of entering in one of the IAgRE Safety Competitions?

Simple guidance and articles on the priorities for the industry is available on the Farm Safety Partnership's website. The priority issues identified by the FSP's Machinery Safety Group and outlined in its Workplan posted on the IAgRE's HSTG webpage [www.iagre.org/sites/iagre.org/files/groups/FSP_MachinerySafetyGroupUpdateActionPlan112014.pdf] might stimulate other ideas.

All of the national regulators' websites regularly highlight relevant incidents and provide useful guidance, eg HSE's SAFE [Slurry, Animals, Falls and Equipment] campaign pages at <http://farm-safe.hse.gov.uk/> and the HSA's website, as well as HSE's [www.hse.gov.uk/index.htm].

IAgRE SAFETY AWARDS

IAgRE has for some years run *The Student Safety Award* which was established to encourage students to think about ways to improve health and safety in the workplace. However, the number of entries has

been disappointing.

Hopefully, College Tutors will use the information highlighted in this article to set design challenges for their students, or students will identify their own potential topics which could make a significant change in the industry.

We also need designers and manufacturers to pick up on some of the ideas proposed, to help turn them into commercial reality.

SSAB, the Nordic-based manufacturers of Advanced High Strength Steel, recognised that safety in agricultural engineering has not progressed as fast as in the automotive industry and to promote innovation in the landbased sector, it joined with IAgRE and *Farmers Guardian* to launch a new annual award for "*an innovation, product or practice which promotes best practice in promoting safety and can demonstrate clear benefits*".

We need designers and manufacturers to pick up on some of the ideas proposed to help turn them into commercial reality

A prize of £300 and a statuette will be awarded to the winner, together with a visit to SSAB's factory in Sweden. The PDF at www.iagre.org/sites/iagre.org/files/docs/IAgRE_SSABSafety_Award2015.pdf explains all the details and how to enter. Details and criteria for all our awards are available on the IAgRE Website [www.iagre.org].

OTHER OPPORTUNITIES?

The journal *Practical Farm Ideas* recently ran a competition based on answering the question, in fewer than 100 words: "*I think farming could be made safer if . . .*".

Examples suggested by the journal included how tractors and other machines are controlled; the training and regulation of farm work; footpaths and the public; the way HSE operates, the dangers to children . . . or anything else.

A recent issue included nine safety related ideas, including a tote bag handler which keeps bags open for easy loading; a hand-cranked PTO turner for a baler; a protective cover for trailer lights; a beacon for ATVs (one of their most popular safety ideas), and a baler unblocker using a simple corkscrew device.

Hundreds of similar simple ideas which make jobs easier, quicker, and hopefully safer have featured in the journal over the years. Most have been developed and built in farm workshops, by people carrying out the tasks themselves. We need to get better at sharing and adopting those ideas worthy of making them more widely available.

Some of you may also be involved with running or judging at County Shows or other organisations or Society events, which offer prizes for innovative designs. It would be helpful if you could influence organisers to consider specific awards for ideas which reduce the risk to health or safety.

ACT NOW . . .

If this article has stimulated you to support our efforts, or even if it has only 'raised your ire' sufficient to make you want to respond, please send any comments to IAgRE CEO Alastair Taylor at ceo@iagre.org.



Arm injury

Importance of effective Electrical Safety Management

A new training opportunity for agricultural engineers to help manage health and safety performance



Danger
electric shock risk

ELECTRICAL RISK MANAGEMENT

Safety in Agriculture is paramount and in view of the poor record in the industry, agricultural engineers have a key role to play in reducing the risks - not just to their clients but within their own businesses.

Many organisations do not have adequate safety management systems with the necessary policies, procedures and competent people. As a result the organisation suffers and it is essential that risks are controlled competently.

Managers can have a difficult task of pointing out to employees, fellow managers and clients that they need to do some things for good reasons. Electricity can be dangerous. It pays to be safe avoiding the cost of incidents. It helps the business run smoothly and business continuity can often be critical to a company's survival.

Clients will expect it. Workers will expect it. The law demands it. The risks can be managed. There are considerable financial and legal implications.

CONSEQUENCES

There are significant consequences for business if there is a serious mistake or incident.

Disruption reduces productivity, causes losses, unpredictable performance and can affect business continuity. Costs arise for the business from the injured person, the additional work and consequential costs for

the company, for the community and prevention of further incidents.

Ignoring these consequences, hoping they will not happen can be an expensive mistake. The new sentencing guidelines will also lead to much higher penalties (both financial and imprisonment) being applied by Courts following prosecutions.

RESPONSIBILITIES

Managers and technical personnel have responsibilities for managing the risks to control the electrical installation and the activities affected by it.

The health and safety of any organisation's workers, contractors and others potentially at risk has to be managed. There have to be policies, procedures and competent people for that system. It is necessary to ensure that persons working at that installation are capable and have their limitations recognised and formally managed. Those working in the agricultural engineering sector are at significant additional risk as they are often working in unfamiliar workplaces.

Often clients and managers lack the competence and confidence to improve their safety management. Safety management has to be made accessible to technical and non-technical people so that risks to people and their business are safely reduced.

There are serious effects of an incident on the company, injured person, other

workers, families, members of public and YOU. Directors and managers can be jailed, large fines and costs can affect the organisation. That's before we start on the other consequential costs and psychological damage!

IAgrE is offering a new training opportunity for businesses involved in the industry to consider your safety management systems, focussing on electrical issues but the principles are equally applicable to all other hazards. This course has been developed for IAgrE by ex-HSE inspectors Bill Bates and Alan Plom.

IAgrE Member **Alan Plom** is known to many of you from his role as Head of HSE's Agricultural Safety Section, before he 'retired' in 2011. He has since remained closely involved in agricultural health and safety, including being a member of the Board of the Farm Safety Partnership and chair of the Machinery Safety Group.

Bill Bates spent many years as an electrical engineer, the last 21 years as an HSE Inspector. During this time he investigated countless incidents, many of which occurred in agriculture and related activities. As a result he is well aware of the risks of getting safety management wrong.

This course builds on their experience in the industry and will help you to reduce the significant risks faced by all businesses working in Landbased industries, not just agricultural engineering.

**Protect your business -
Control your own risk -
Comprehensive New
One Day Course**

When: Tuesday 29th September 2015 or Tuesday 17th November 2015

Where: IAgrE, The Bullock Building (53), University Way, Cranfield MK43 0GH

Cost: £350.00 plus VAT

Booking Form: www.iagre.org/eventbookpay/SafetyCourse

IAgrE guide to CPD

With the Engineering Council requiring IAgrE to sample the CPD records of a proportion of active registered members, **IAgrE CEO Alastair Taylor** shares the Institution's approach to promoting and recording CPD.

The good news is that IAgrE offers a great range of training and development opportunities and in addition, members participate in many activities which contribute to their progression within our industry. IAgrE is working hard to ensure that systems for recording CPD are easy to use. This article explains more.

THE IAgrE PLEDGE TO YOU

As a professional society, IAgrE has a commitment to providing a wide range of Continuing Professional Development (CPD) events.

We also offer a system for you to be able to register your CPD with IAgrE in order that we provide suitable feedback and support. For those members registered with the Engineering Council and Society for the Environment, IAgrE is required to conduct an annual sample of CPD records.

UNIVERSAL DEFINITION OF CPD

All Professionals need to enhance their professional competences throughout their working lives to take into account changes in technology and business practice. Each Professional is responsible for taking appropriate action to update and develop knowledge and skills relevant to his or her current job and career interests and to anticipate future requirements.

The process of Continuing Professional (or Personal) Development is essential in maintaining and developing professional competence. CPD is described as -

“The systematic maintenance, improvement and broadening of knowledge and skill, and

the development of personal qualities necessary for the execution of professional and technical duties throughout the individuals working life.”

The central aims of CPD are to:

- **Enhance career prospects**
- **Contribute to business performance**

Benefits to the individual are the ability to:

- **Provide a high quality service**
- **Achieve greater job satisfaction**
- **Improve employability**

IAgrE APPROACH TO CPD

IAgrE promotes CPD to all its members and has adopted what it considers to be a pragmatic approach to the registering and recording of members CPD.

Whilst participation in the IAgrE scheme is voluntary, evidence of CPD is a requirement of all those registered with the Engineering Council and Society for the Environment. Evidence of CPD will be required from any member applying for an upgrade of membership and/or registration.

IAgrE does not use a monitored points or hours system but does expect the attainment (and recording) of at least 30 hours

of CPD in each year. Members are encouraged to send their CPD records to IAgrE for review and comment.

TYPES OF CPD

Three general types of CPD are envisaged:

- A. Development of technical expertise and knowledge relevant to one's profession.**
- B. Extension of technical and managerial skills beyond the participant's normal field.**
- C. Development of professional life skills and knowledge such as:**

- *languages*
- *finance*
- *law*

WHAT CONSTITUTES CPD?

Activities which can be counted as CPD include conferences, courses and seminars, organised visits, writing articles or papers, IAgrE committee work, IAgrE technical meetings, professional updating by reading or private study, secondments and exchanges, further education, distance or open learning.

The table over the page gives specific examples:

continues over

TYPE OF CPD	TYPICAL EXAMPLE
Training	• Soft skills courses • Technical courses • E-learning/distance courses • In-company training courses • Courses leading to qualifications • Preparing materials for training courses • Delivering training courses
Work experience	• Learning by doing the job and developing experience • Talking to suppliers, customers or specialists and working with them to determine their technical requirements • Receiving coaching from others • Secondments and job rotation • Job shadowing • Apprenticeships • Promotion to a new role • Coaching / training others • Supervising / managing / leading others • Presentations to external clients, colleagues, etc • Preparing and presenting reports • Managing projects, budgets, teams, etc.
Academic study	• Masters degree (e.g. MEng, MSc) • PhD/Doctorate • Bachelors degree (e.g. BEng, BSc) • HND • HNC • City & Guilds • NVQ • BTEC
Volunteering	• Professional body volunteering roles e.g. mentoring, local network roles, professional registration interviewer, committee roles, etc. • Other volunteer roles that support the development of soft skills / financial / leadership skills e.g. scout / guide leader, charity work, local organisations, etc • Speaking at an event • Membership of a technical expert group
Events and seminars	• Conferences • Networking events • Technical visits • Exhibitions • Webinars • Seminars • Lectures • Organising meetings or events • Speaking at an event • Lecturing or teaching
Self-study	• Reading books, journals and articles • Research through internet searches and digital information sources • Appropriate TV broadcasts • Online technical communities & discussion forums

Planning your CPD

Doing your CPD

Recording your CPD

Reviewing your CPD

MANAGING YOUR CPD

How you manage your CPD will depend upon your stage of career development. You might fall into the following broad categories:

- You are a 'pre-professional' using CPD in developing your job role and building up a portfolio of knowledge and experience to help you prepare for registration with the Engineering Council or Society for the Environment.
- You are an established engineer, a member of IAgRE and registered with the Engineering Council or Society for the Environment maintaining your expertise and professionalism through a range of CPD activities.

In all cases you are likely to be using the standard professional development cycle as illustrated above.

CPD RECORDING

It is essential that you record your CPD. *Many employers use their own systems to record training and CPD and for many IAgRE members, a record from their employers system is likely to meet all CPD recording requirements.* In addition, IAgRE offers two means of recording CPD:

mycareerpath®

The *mycareerpath* Professional Development System is an online tool allowing engineers and technicians to plan, evidence and report their professional development activities.

IAgRE views this as being an especially useful tool if you are a 'pre-professional' using CPD in developing your job role and building up a portfolio of knowledge and experience to help you prepare for registration with the Engineering Council or Society for the Environment.

The user selects a competence profile (e.g. Chartered Engineer) and can create personalised development plans which detail how they intend to demonstrate the competences within the profile.

Evidence can be recorded against competence profiles, and reports created to draw together plans and evidence. Plans, reports and evidence can be reviewed by a third party, exported to PDF, and printed.

The competence statements for EngTech, IEng and CEng (taken from the UK Standard for Professional Engineering Competence) are built into *mycareerpath*. Use these profiles if you are working towards (or intending to work towards) one of these grades of professional registration.

mycareerpath can also be used to record Continuing Professional Development (rather than progress towards a competence profile like CEng). By selecting

'Continuing Professional Development' as a profile, the user can plan, record and report any and all activity that contributes to professional development.

IAgRE CPD Tracker

This is a password protected spreadsheet that allows you to record the following information about your CPD:

- Date, Month Year
- Organiser, Location, Function
- Hours of CPD logged
- General Learning Outcomes

and as appropriate to you and your personal development:

- Mapping to IAgRE CPD Criteria A, B and C.
- Mapping to Engineering Council UK-SPEC for CEng, IEng, and EngTech.
- Mapping to Society for the Environment for CEnv and REnvTech.

CPD SAMPLING BY IAgRE

The Engineering Council and Society for the Environment requires IAgRE to sample members CPD records. This is overseen by the IAgRE Education and Training Committee.

When a member is requested to supply CPD records, they will be given one month to respond.

Institution of Agricultural Engineers (IAgrE) Continuing Professional Development (CPD) Tracker								
Name:	Alastair Taylor	IAgrE CPD Specifications A. development of technical expertise and knowledge relevant to one's profession. B. extension of technical and managerial skills beyond the participant's normal field C. development of professional life skills and knowledge such as languages, finance, law, etc						
IAgrE Grade:	MIAgrE							
Registrations:	IEng CEnv							
Update Date:	29-May-15							
						For details of Eng CUK-SPEC/Soc Env Criteria see separate sheet tabs below		
Date	CPD Organiser	Location	Function/Event/Activity	Hours	Outcomes/Comments	IAgrE Spec	UK-SPEC Ref	Soc Env Ref
20-May-15	IAgrE	Newcastle	Annual IAgrE Conference - Too Much or Too Little Water	6	Attend conference held at Newcastle University. Six papers covering land drainage, run off management, LEAF, water sensors, drainage equipment technologies, water management. Networking opportunities with other professionals	A, B	IEng, A2	CEnv A1, D2
21-May-15	N/A	Melton Mowbray	Presentation of awards to Apprentices	1	Presentation of awards to Apprentices working for GRIMME. Discussions with GRIMME senior managers on training and education and technology application	C		

MEMBERSHIP ENQUIRIES

IAgrE

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www.iagre.org



Issue 70 Number 3 Autumn 2015

MEMBERSHIP MATTERS

BRANCH REPORTS

SOUTH EAST MIDLANDS BRANCH

JORDAN'S MILL AND ENERGY EFFICIENCY

The South East Midlands Branch traditional end of term visit took us to Jordan's Mill at Broom in Bedfordshire, in May 2015, bringing to a close another wide ranging programme of technical meetings. It also took us back to the theme of Renewable Energy which has run throughout our meetings over recent years.

Having visited an on-farm AD plant, wind and solar power sites during last year's Tour we have now completed the set of renewable energy sources by visiting this water-powered mill, following our previous meetings covering the essential elements of earth, wind and fire. We also had a presentation in January on 'The Challenges of Agricultural Energy Efficiency'. Could we be more energy-efficient than that?

Jordan's Mill

This historic mill, home to the Jordan family for over 150 years, was revolutionary for its time and could be compared with the dawn of the internet age today.

Milling was once a major industry with over 400 mills in Bedfordshire alone. Sadly, very few are still working. Set on the River Ivel near Biggleswade [not far from the source of the original Ivel tractor, but that is another story we covered at a SEM Branch meeting many moons ago!], this water-powered grain mill has been restored over the past decade. The restoration was funded by the Jordan family and through a Lottery Grant and as it preserves a milling site that was first mentioned in the Domesday Book of 1086, well worth the £2million it cost!

After an interesting and amusing introduction to the history of the Jordan family and development of the site [where the very successful Jordan's Cereal Bar enterprise was founded], we toured the Mill. Now back in pristine condition, the mill's machinery is still maintained by an original member of staff. The sluice was opened and the turbine turned on for our benefit.

The amazing renewable energy factoid revealed on this Tour was that the whole mill is driven by a single 25hp water turbine - itself innovative in its day, and incredibly efficient. Another engineering innovation at this Mill was the first use of metal 4-roller mills, developed by Henry Simon.

A fire at the mill in 1894 brought about the change from traditional stone milling to



The group at Jordan's Mill

metal roller mills. This technological leap enabled the Mill to increase production significantly and produced finer quality flour, helping Jordan's Mill to become one of the leading producers in the region. This also paved the way for similar mechanisms to be used in the developing cement industry, and others.

Today, the refurbished mill sits tall and proud and will stay an impressive part of the local landscape for future generations to enjoy. It has already become a popular educational visitor attraction, with the Mill building being divided in two by a floor-to-ceiling glass screen - the working part of the mill on one side and a contemporary display area on the other side. The story of each floor and the role it plays within the mill is told in a lively and interactive way.

So, together with its excellent restaurant, Jordan's Mill is well worth a visit if you are passing nearby on the A1 and have an hour or two to spare. For further details see: <http://jordansmill.com/>.

The Challenge of Energy Efficiency

Bringing us back into this Century, Jon Swain, Senior Engineer at the Farm Energy Centre (FEC) gave a very informative and thought-provoking talk, back in March. Jon described how the current agricultural situation presents unique and interesting challenges to reducing energy consumption, especially considering the rise of renewable energy subsidies.

Jon compared the alternatives and explained the various complex subsidies, feed-in-tariffs, etc, and the politics behind them - a tall order! He also described several of the latest initiatives and energy-saving

technologies that the FEC are involved in and talked about how to reduce consumption and use renewable energy better.

Selecting the right implement for the job and maximising work-rate and field efficiency can obviously save large amounts of fuel, and Jon's slides emphasised the importance of purchasing policy (e.g considering OECD test data, looking for fuel efficient machines, considering PTO & Drawbar power requirements, etc) and recording fuel use against tasks and hours to build up a comparison of fuel efficiency against job, machine and driver, for each machine. He also mentioned managing tyre pressures, eg using an App.

This was the basis of the EU funded Efficient 20 project, aiming to save 20% of fuel by 2020.



Thousands of fuel measurements from a wide variety of agricultural and forestry operations have been recorded on a shared database, set up for farmers and foresters from across the 9 participating European countries. This enables farmers and foresters to compare their fuel measurements and determine which fuel-saving techniques

have the greatest impact in reducing their fuel consumption.

A number of local farmers took part in this project and provided information. For more information on the E20 Project, see: <http://uk.efficient20.eu/2012/07/18/fuel-efficiency-guide/>.

The Project concluded that "Only a skilled and motivated driver can put these fuel-saving measures into practice" - hence the production of a Trainer's Manual', issued under

the banner: 'Intelligent Energy, Europe' [ref: IEE/O9/764/S12.558250 - in particular, see section D 3.8 'Strategies for Saving Fuel with Tractors'.

[http://ec.europa.eu/energy/intelligent/projects/sites/iee-projects/files/projects/documents/efficient20_trainer_handbook_en.pdf]

In conclusion

Jon convinced us that "using renewable energy better" should be the mantra for the

future but his sound advice on other issues such as choice of car engines and lighting was equally applicable to us all in our domestic lives, making this meeting well worth attending. I commend the topic (and the speaker) to other Branches.

For further information or any questions on Energy Efficiency, contact the FEC at Stoneleigh, via www.farmenergycentre.co.uk (tel 024 7669 6512).

Alan Plom

WEST MIDLANDS BRANCH

MARTON MUSEUM OF RURAL BYGONES

"What an intriguing mixture of things!" This was the general reaction to the visit.

We were greeted by David Fry and some of the other trustees and given a generous tea and cakes welcome and then a brief introductory talk.

The collection was created by George Tims who kept being given large numbers of old objects most of which had a rural or farming connection. Many were due to be thrown out or scrapped and he provided a good home where such gifts were appreciated.

This museum shows many items of historical interest. The collection grew using any spare local building he could find. Then a developer wanted to put an estate on the farmyard where they were housed and part

of the deal was to build a sports pavilion, and the current museum building. Although almost everything is inside the building they feel they have outgrown it.

George died a few years ago and the collection is now run by a group of trustees drawn from the village.

We were impressed by the enthusiasm of all the people we met. The trustees might be looking after the collection but sometimes they are not sure what they have. From our group we were able to answer some of their queries. Most of the trustees do not have a farming background so several of our party had used or were still using some of the items on display!

If their planned Heritage Lottery fund is successful they want to gain more, much



needed, space and rearrange items in a more logical order than they are currently able to.

Space is limited and our party of eleven had to take turns to get into some corners!

William Waddilove

INTERNATIONAL SOCIETY OF PRECISION AGRICULTURE

REPORT ON 10ECPA

Another successful European Conference on Precision Agriculture - the 10th - was held in the Volcani Centre, Tel Aviv, Israel in July.

Around 300 delegates listened to 100 oral paper presentations and viewed a large number of posters under a general conference theme of 'Precision agriculture for efficient resource management under changing global conditions'.



Spot the UK contingent!

The unique feature of ECPA is the quality of papers presented orally, each of which is subject to two scientific assessors, moderated by the Proceedings editor and revised before acceptance. The resulting hard-bound Proceedings (published by Wageningen Academic Publishers - www.wageningenacademic.com/doi/book/10.3920/978-90-8686-814-8) will be an ongoing reference source for PA researchers.

The conference, which was ably organised by Prof Victor Alchanatis, a leading PA researcher in Israel, was a unique networking opportunity with such a mix of disciplines amongst the delegates - including ag engineers, soil scientists, crop scientists, agronomists, ag economists, remote sensing and sensor experts.



Conference co-chair, Victor Alchanatis with Proceedings Editor, John Stafford

At the end of the conference, there was a professional tour of Israeli PA research including aerial imaging, UAVs, thermal imaging, mechanical weeding, autosteering and crop sensors.

The conference series comes under the auspices of the International Society of Precision Agriculture with the 11th scheduled to take place in Edinburgh in July 2017.

John Stafford
Proceedings Editor, Past-President, ISPA

Membership changes

Admissions

A warm welcome to the following new members:

Member

Al Sheeti TM (UAE)
Copnall S (Wrekin)

Associate Member

Grandio Barro S (South Eastern)
Filmer S (South Eastern)
Holliday D (Western)
Jaggard LM (South East Midlands)
Johnson M (Scottish)
Okoye NM (Nigeria)
Randall J (East Anglia)
Whitehead D (Scottish)
Wood W (Scottish)

Associate

Ambayo EO (Kenya)
Davenport L (East Midlands)
Khan S (Saudi Arabia)

Commercial

Fullwood

Student

Harper Adams University
Adeyemi O

Transfers

Member

Gumbe LOM (Kenya)
Canavari M (Italy)

Associate Member

Bonnett S E (Herts & Essex)
Babi Almenar J (East Anglia)
Thomas J W (East Anglia)

Deaths

We have recently learned of the death of the following members and we send our condolences to their family and friends.

Mr Frank Bryant AIAgrE, (Wrekin Branch) a member since 1958.

Mr Brian F Fraser-Smith FIAgrE, (South Western) a member since 1979.

Mr Oliver J H Statham MIAgrE, (South East Midlands), a member since 1964.

Engineering Council

Congratulations to the following members who have

qualified as Incorporated Engineers and Engineering Technicians entitling them to use the designatory letters IEng and EngTech after their name.

Registrations

IEng

Purdy DJ (Herts & Essex) - re-registration

EngTech & LTA3

Filmer S (South Eastern)
Holliday D (Western)
Jaggard LM (South East Midlands)
Johnson M (Scottish)
Randall J (East Anglia)
Whitehead D (Scottish)
Wood W (Scottish)



Long service certificates

Name	Grade	Date of anniversary
60 years		
Derek John Greig	FIAgrE	08/09/2015
35 years		
Jonathan Richard Appleton	AMIAgrE	14/07/2015
Robin William Sadler	CEng FIAgrE	18/07/2015
Timothy Genn Elmhirst	AMIAgrE	25/07/2015
Martin Ian Howard Bennett	MIAgrE	31/07/2015
Nimal Ranjan Perera	CEng MIAgrE	21/08/2015
Christine Scott Clark	CEng FIAgrE	16/09/2015
25 years		
Thomas James Hyatt	AMIAgrE	09/07/2015
Geoffrey William Burgess	FIAgrE	12/07/2015
Martin Francis Hopper	IAgrE	17/07/2015
Jervis Chong Kat Fung	AMIAgrE	03/09/2015
Keith Bartlett	IEng MIAgrE	14/09/2015
Alfred James White	AMIAgrE	18/09/2015
Ian William Makin	AMIAgrE	27/09/2015

We want to hear from members

Send branch reports
or correspondence to:

The Editor, Chris Biddle

Email: chris.biddle@btinternet.com

Or the IAgrE Communications Officer, Marion King on:
pressroom@iagre.org

Landwards

Academic members

Babcock Training Ltd
Babcock
Ruddington Fields Business
Park
Ruddington
Nottingham
NG11 6JZ

Bicton College
East Budleigh
Budleigh Salterton
Devon
EX9 7BY

Bishop Burton College
York Road
Bishop Burton
Beverley
HU17 8QG

Brooksby Melton College
Asfordby Road
Melton Mowbray
Leics
LE13 0HJ

Coleg Sir Gar
Gelli Aur Campus
Llandeilo
Carmarthenshire
SA32 8NJ

Cranfield University
Cranfield
Bedfordshire MK43 0AL

Easton & Otley College
Easton
Norwich
Norfolk, NR9 5DX

Greenmount Campus
CAFRE
22 Greenmount Road
Antrim, Northern Ireland
BT41 4PU

Harper Adams University
Newport
Shropshire
TF10 8NB

Institute of Technology
Tralee
Clash, Tralee
Co Kerry, Ireland

Myercsough College,
Bilsbarrow
Preston
Lancashire
PR3 0RY

Newcastle University
King's Gate
Newcastle Upon Tyne
NE1 7RU

Pallaskenry Agricultural
College
Co Limerick
Ireland

Plumpton College
Ditchling Road
Lewes
East Sussex, BN7 3AE

Reaseheath College
Reaseheath, Nantwich
Cheshire, CW5 6DF

Royal Agricultural
University
Cirencester
Gloucester, GL7 6JS

Sparsholt College
Sparsholt, Winchester
SO21 2NF

SRUC - Auchincruive
Auchincruive Estate
Ayr, KA6 5HW

Wiltshire College -
Lackham
Lacock
Chippenham
Wiltshire
SN15 2NY

Commercial members

Agricultural Engineers
Association (AEA)
Samuelson House,
62 Forder Way,
Hampton, Peterborough,
PE7 8JB

AGCO Ltd
Stoneleigh, Abbey Park,
Kenilworth, Warwickshire,
CV8 2TQ

Alvan Blanch Development
Co, Chelworth,
Malmesbury, Wiltshire
SN16 9SG

Autoguide Equipment Ltd
Stockley Road
Heddington
Calne, Wiltshire,
SN11 0PS

BAGMA
Middleton House,
2 Main Road,
Middleton Cheney,
Banbury,
Oxon,
OX17 2TN

Bomford Turner Limited
Salford Priors
Evesham
Worcestershire
WR11 5SW

David Ritchie (Implements)
Ltd
Carseview Road
Suttieside
Forfar,
Angus,
DD8 3EE

Douglas Bomford Trust
The Bullock Building
University Way,
Cranfield
Bedford,
MK43 0GH

FEC Services
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2LS

Fullwood
Grange Road
Ellesmere
Cheshire SY12 9DF

Huntaway Consulting
Ivy Cottage
Torlundy
Fort William
Inverness-shire
PH33 6SW

John Deere Ltd
Harby Road
Langar
Nottinghamshire
NG13 9HT

Shelbourne Reynolds
Shepherds Grove Ind. Est.
Stanton
Bury St Edmunds
Suffolk, IP31 2AR

SSAB Swedish Steel Ltd
Narrowboat Way
Hurst Business Park
Brierley Hill
West Midlands
DY5 1UF

TeeJet London Ltd
Headley House,
Headly Road,
Hindhead, Grayshott
Surrey, GU26 6UK

EVENTS

IAgrE Branch Meetings and Events**West Midlands Branch****Tuesday 22 September 2015, 18.30**

VISIT TO CLIFTON HALL FARM & MAGPIE LODGE FARM

Venue: Magpie Lodge Farm, Lilbourne Road, Clifton on Dunsmore CV23 0BB

Visit to Clifton Hall Farm and Magpie Lodge Farm courtesy of Jenny and Roger Spencer. We will have a farm walk to see their pioneering English Nature conservation projects and see how well conservation can be incorporated into modern mixed farming practice. The visit will include their private collection of working machinery dating back to the 1950s to today and all in regular farm use. Commencing 1830 please gather in Magpie Lodge Farm yard (100 yards beyond Clifton Hall Farm) Lilbourne Road, Clifton on Dunsmore CV23 0BB (Nearer the A5) Please wear suitable footwear for a farm walk.

Pre-booking is essential, please contact the Branch Chairman (Ian Moore) IanM@Whale.co.uk or Branch Secretary (Michael Sheldon) michael-c-sheldon-iagre@outlook.com so that your name can be added to the attendance list and so you can check the status of the event.

Tel: 01926 498900 Email: michael-c-sheldon-iagre@outlook.com**Western Branch****Wednesday 30 September 2015, 19.00**

PRESENTATION: 'MY TIME AT RDS'

Speaker: Richard Danby, RDS Technology

Venue: Wiltshire College Lackham, Lacock, Chippenham, SN15 2NY

Richard will be giving a presentation on his time at this manufacturer of Agricultural electronic products

Contact Branch Secretary Glen Craig for more information

Tel: 07985 756001 Email: glenrcraig@btinternet.comWeb: <http://www.rdstec.com/>**Northern Ireland Branch****Tuesday 6 October 2015**

MY ENERGY EFFICIENT HOUSE

Speaker: Bob Armitage

Venue: Ballynahinch

Visit to site led by Bob Armitage

For more information please contact Branch Secretary Ian Duff

Tel: 028 8673 6977 Email: duffi@iagre.biz**Wrekin Branch****Monday 12 October 2015, 19.30**

BAE SYSTEMS TALK BY TIM STACEY - SUBJECT TBC

Venue: Agricultural Engineering Innovation Centre at Harper Adams University

Tea & Coffee will be served from 1900. For more information please contact Branch Secretary David Clare

Email: dclare@harper-adams.ac.uk**East Midland Branch****Tuesday 13 October 2015, 19.00 for 19.30**

VISIT TO LINCOLNSHIRE HERITAGE AVIATION MUSEUM

Venue: Lincolnshire Heritage Aviation Museum, East Kirby, Spilsby, Lincs PE23 4DE

This is the home of "Just Jane", a nearly flying Lancaster Bomber. The evening will include a tour of the workshops, the aircraft and other areas.

NB as it is a charity there will be a charge of £7 per person.

Tel: 01509 215109 Email: richard.trevvarthen@gmail.com**Pioneering Technology Specialist Group****Saturday 17 October 2015, 10.30**

VISIT TO MARTON RURAL MUSEUM & MODEL ENGINEERING EXHIBITION

Venue: Marton Museum, Louisa Ward Close, Marton CV23 9SA

Visit to Marton Rural Museum near Southam followed by the Model Engineering Exhibition, Fosse Way, Warwickshire. This event is organised by the Pioneering Technology Specialist Group.

There will be a charge for both events.

All enquiries and bookings to William Waddilove

Tel: 02476544255 Email: william@waddilove.co.ukWeb: <http://www.martonvillage.com/index.php/museum>**South East Midlands Branch****Monday 19 October 2015, 19.30**

THE ENGINEERING CHALLENGES OF WEED CONTROL

Speaker: Dr Paul Miller

Venue: Maulden Church Hall, Church Road, Maulden, MK45 2AU

The related problems of resistance, herbicide availability and the pressure to minimise pesticide use for environmental and human safety reasons mean that the control of weeds in both arable and horticultural crops is now particularly difficult. This talk will look at some of the engineering options that have been developed to address these problems.

For more information please contact Branch Secretary John Stafford

Tel: 01525 402229 Email: john.stafford@silsoe-solutions.co.uk**West Midlands Branch****Tuesday 3 November 2015, 19.30**

LAND DRAINAGE PRESENTATION

Speaker: Rob Burtonshaw, Farm Services Ltd

Venue: Friends Meeting House, Stratford upon Avon, CV37 6XT

This company based at Chesterton, Warwickshire specialises in sportsfield and agricultural drainage providing a service covering consultation, design, construction, maintenance and water management. They have carried out work at Warwick Castle, Local sports grounds and Camp Hill School as well as Agricultural drainage.

For more information please contact Branch Secretary Mike Sheldon

Tel: 01926 498900 Email: michael-c-sheldon-iagre@outlook.comWeb: <http://www.farmservicesltd.co.uk/>**South East Midlands Branch****Monday 9 November 2015, 19.30**

TELEMATICS

Speaker: Micheal Ives, Claas

Venue: Maulden Church Hall, Church Road, Maulden, MK45 2AU

Contact Branch Secretary John Stafford for more information

Tel: 01525 402229 Email: john.stafford@silsoe-solutions.co.uk**Wrekin Branch****Monday 9 November 2015, 19.30**

EFFICIENT WATER USE & IRRIGATION SYSTEMS DEVELOPMENT

Speaker: Anthony Hopkins, Wroot Water

Venue: Agricultural Engineering Innovation Centre at Harper Adams University

Tea & Coffee are available from 1900 and the meeting starts at 1930. Contact Branch Secretary David Clare for more information

dclare@harper-adams.ac.uk Web: <http://www.wrootwater.com/>**East Midlands Branch****Tuesday 10 November 2015, 19.00 for 19.30**

VISIT TO STRAW BURNING PLANT - TBC

Venue: Sleaford, Lincs This meeting will be confirmed and details to follow. Tel: 01509 215109 Email: richard.trevvarthen@gmail.com

Western Branch**Wednesday 11 November 2015, 14.00**

FARM VISIT & TOUR OF ICE CREAM PRODUCTION FACILITY

Venue: Woodlands Farm, Chedworth, Glos

Please contact Branch Secretary Glen Craig for more information

Tel: 07985 756001 Email: glencraig@btinternet.com

Web: <http://www.woodlandsfarmltd.co.uk/>**Wrekin Branch****Monday 23 November 2015, 19.30**

WREKIN BRANCH - YOUNG ENGINEERS PUBLIC SPEAKING COMPETITION

Venue: Agricultural Engineering Innovation Centre at Harper Adams University.

A competition open to any IAgRE members aged 25 years or younger. Give a 10 minute presentation on any topic linked to Agricultural Engineering.

Contact Branch Secretary David Clare for more information

Tea & Coffee are served from 1900 and the event will start at 1930

Email: dclare@harper-adams.ac.uk

West Midlands Branch**Tuesday 1 December 2015, 19.30**

KAWASAKI ENGINES – EVOLUTION OF THE TURFCARE ENGINE

Speaker: Alex Braun from Kawasaki Motors EU

Venue: Friends Meeting House, Stratford upon Avon, CV37 6XT

Alex will take a look at how turfcare equipment has changed over the years and how engines have evolved to suit customer demands. He will also consider the problems and changes that that have had to be overcome to reach today's engine designs.

For more information please contact Branch Secretary Mike Sheldon

Tel: 01926 498900 Email: michael-c-sheldon-iagre@outlook.com

Web: <http://www.kawasaki.eu/en/products>**South East Midlands Branch****Monday 7 December 2015, 19.30**

THE CONCEPT, PRACTICE & BENEFITS OF STRIP-TILLAGE

Speaker: George Sly, Sly Agri Ltd

Venue: Maulden Church Hall, Church Road, Maulden, MK45 2AU

George will take us through the concept of strip tillage that aims to reduce mechanisation costs while improving fertiliser use efficiency and combining the benefits of ploughing and no-till. Use of the Stripcat strip till cultivator will be demonstrated in a range of cover and cash crops.

Contact Branch Secretary John Stafford for more information Tel:

01525 402229 Email: john.stafford@silsoe-solutions.co.uk

Web: <http://www.slyagri.com/Index.html>**Wrekin Branch****Monday 7 December 2015, 19.30**

JOHN DEERE FOREST MACHINERY - FURTHER DETAILS AND SPEAKER TBC

Venue: Agricultural Engineering Innovation Centre at Harper Adams University Please contact Branch Secretary David Clare for more information. Tel: 01952 815087

Email: dclare@harper-adams.ac.uk

East Midland Branch**Tuesday 8 December 2015, 19.00**

VISIT TO GRIMME (UK) LTD

Venue: Grimme (UK) Ltd, Station Road, Swinshead, Boston, Lincs PE20 3PS

With over 150 types of machines, Grimme offer a comprehensive product range in the potato, beet and vegetable technology. In the vegetable technology Grimme and their subsidiary ASA-LIFT build a variety of innovative machinery around the harvest of onions, beet-root, carrots, leeks, chives, celery, fennel, peas, lettuce, etc.

Tel: 01509 215109

Email: richard.trevarthen@gmail.com

Other Events:**Tuesday 29 September 2015****IAgRE Head Office****ELECTRICAL SAFETY MANAGEMENT FOR AGRICULTURAL ENGINEERS**

Speaker: Bill Bates & Alan Plom

Venue: IAgRE Head Office, The Bullock Building, University Way, Cranfield MK43 0GH

Electrical safety in agriculture and associated subjects has never been more important. The dangers of high voltage systems are well known and with bigger machinery, the risks of coming into contact with high voltage power lines is as great as ever. Add to this the developments in farm machinery with more low voltage circuits, electrical controls, and complex management and control systems, the need to manage electrical safety has never been more vital.

This event will help you to avoid production/project costs and delays from stoppages caused by electrical-related accidents, as well as personal death or injury and costs and reputation damage from litigation resulting from poor electrical safety practices. IAgRE has joined forces with the IET to promote best practice and all delegates received the IET's Code of Practice for Electrical Safety Management. Cost £350.00 + vat per delegate

Course delivered by Bill Bates FIEE, FIET Director Foxgloves Electrical Safety Management Limited and Alan Plom, MIAgRE IOSH Rural Industries Group Vice Chair / Communications Coordinator / Farm Safety Partnership Board Member / Machinery Safety Group Chair Tel: 01234 750876

Email: secretary@iagre.orgWeb: www.iagre/events**Monday 12 October 2015, 1400-1830****Royal Academy of Engineering****RAEng INNOVATION IN AGRI-TECH**

Speaker: Various - chaired by Dick Godwin, FREng, HonFIAgRE, CEnv

Venue: Royal Academy of Engineering, 3 Carlton House Terrace, London SW1Y 5DG

This latest in the Academy's *Innovation in...* series of events will showcase a selection of some of the most recent advances in agri-tech. Chaired by Professor Richard Godwin FREng, Visiting Professor of Harper Adams University, the afternoon will focus on technologies that have successfully reached market or are expected to in the next 5 to 10 years. Topics will include precision farming, animal health and water. There will also be a panel discussion with key leaders in the sector.

Ticket cost: £20.00 including VAT. Contact Jane Divito for info.

Email: jane.divito@raeng.org.ukWeb: <http://www.raeng.org.uk/events>**3 & 4 November 2015****Rethink Events Ltd****WORLD AGRI-TECH INVESTMENT SUMMIT 2015**

Venue: Double Tree by Hilton, 7 Pepys Street, London EC3N 4AF

Returning to London for two days of networking and debate, global agribusinesses, VC investors and technology start-ups from around the world come together to uncover the most exciting innovations in agricultural technology – and to forge the right partnerships to take those solutions to market. Attracting delegations from the US, Europe, the Middle East and Africa, this is a summit where connections are made: accelerating the transition of technology from the lab to the field.

IAgRE members can claim a £200 saving on registration. Just quote IAGRE15 when you book.

Web: worldagritechinvestment.com/the-summit/**Full details of forthcoming events can be found on www.iagre.org/events**

Academic & Commercial membership



IAgrE

IAgrE is a registered charity working for the public benefit through bringing together academics, practitioners and industry to share knowledge and promote professionalism in the advancement and application of technology in the landbased sector.

Joining our commercial membership demonstrates a commitment to professional development and keeps you up-to-date with all the latest developments.

Key Benefits of Membership

- Free copy of Landwards, our quarterly journal with advertising opportunities
- Advertising of jobs on the IAgrE website
- Priority places and early bird discount at our annual conference
- Table space at our conference and other events
- Access to branch, technical meetings & hubs
- Product promotion and opportunities for guest speakers
- Sponsorship opportunities
- Access to CPD and training
- Online presence on our website and social media with your logo
- Fulfils your corporate social responsibility and shows your support of the industry
- Access to the latest e-news and business news
- Use of IAgrE CPD recording system
- Access to the latest developments within the industry
- Opportunities to reach your target customers
- Access to IAgrE archives
- Professional development and CPD recording

Levels of membership

£150 for academic members

£200 for commercial members with less than 50 employees

£300 for commercial members with more than 50 employees

For more information on our membership schemes, please contact Sally Wood,
email projects@iagre.org, 01234 750876



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